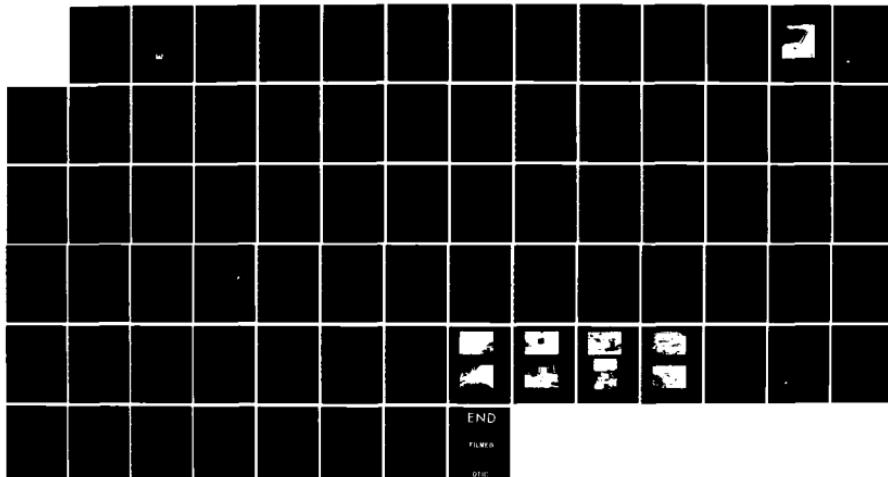
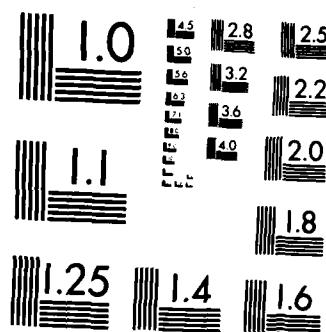


AD-A154 790 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
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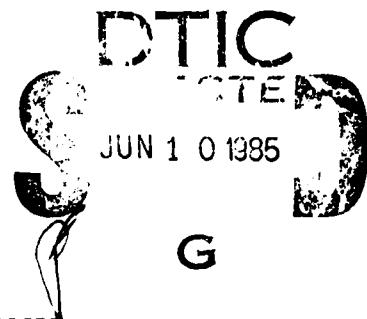
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BLACKSTONE RIVER BASIN
AUBURN, MASSACHUSETTS

6
UPPER STONEVILLE DAM
MA 00196

**PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM**

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**DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154**

APRIL 1979

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Blackstone River Basin Auburn, Mass		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Upper Stoneville Reservoir Dam is a 420-foot long, 15-foot high earthfill dam with a nearly vertical downstream dry stone masonry wall for the downstream masonry face. Generally, the dam is in "fair" condition. According to the Corps of Engineers' guidelines for the classification of hazard potential, the dam has been placed in the "high" hazard category.		



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

JUN 29 1979

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor King:

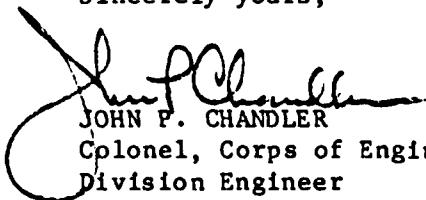
I am forwarding to you a copy of the Upper Stoneville Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, Massachusetts Electric Company, 939 Southbridge Street, Worcester, Massachusetts 01610, ATTN: Mr. Barry Huston, District Superintendent.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely yours,


JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

UPPER STONEVILLE RESERVOIR DAM

MA 00196

BLACKSTONE RIVER BASIN
AUBURN, MASSACHUSETTS

PHASE I - INSPECTION REPORT
NATIONAL DAM INSPECTION
PROGRAM

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NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00196

Name of Dam: Upper Stoneville Reservoir

Town: Auburn

County and State: Worcester County, Massachusetts

Stream: Chapin Brook - a tributary of Blackstone River

Date of Inspection: November 16, 1978

Upper Stoneville Reservoir Dam is a 420-foot long, 15-foot high earthfill dam with a nearly vertical downstream dry stone masonry wall for the downstream masonry face. The dam was built in the late 1800's. There are two operable 2-foot by 2.5-foot gates at the main spillway. A 15-inch diameter low-level outlet located near the center of the dam has not been operated in recent years. The main spillway, which has an effective weir 15 feet long, has been excavated into natural ground at the east end of the dam (right abutment). The auxiliary spillway, which has a weir length of 25 feet, is located at the west end (left abutment). Discharge from the dam enters Stoneville Pond about 1,000 feet downstream from Stoneville Reservoir.

There are deficiencies which must be corrected to assure the continued performance of this dam. This conclusion is based upon the visual inspection at the site, the available engineering data, and limited evidence of operational and maintenance procedures. Generally, the dam is in "fair" condition. According to the Corps of Engineers guidelines for the classification of hazard potential, the dam has been placed in the "high" hazard category.

The following are visible signs of distress which indicate a potential hazard at the site: seepage at the downstream toe, voids in the vertical stone masonry wall of the dam where smaller stones are missing, and vertical,

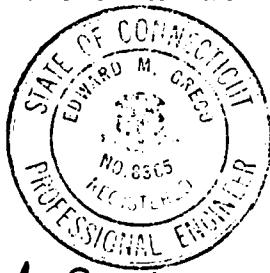
UPPER STONEVILLE RESERVOIR DAM

randomly located fractures in the stone blocks. In addition, riprap near the main spillway should be replaced. The low level outlet gates should be repaired. Small trees and brush should be removed from the crest of the dam and downstream area.

Hydraulic analyses indicate that both spillways can discharge 940 cfs or 59 percent of the test flood with the water surface at Elevation (El) 573.3, which is the lowest elevation on the dam over which discharge will occur. The outflow test flood, amounting to 1,590 cfs, one-half the probable maximum flood (PMF), will overtop the dam by 0.8 feet at a water surface of El 574.1. The analysis assumes that all flashboards have been removed.

It is recommended that the Owner engage a qualified consultant to evaluate the seepage at the downstream toe, fracturing of the blocks in the downstream wall, and feasibility of raising the embankment to prevent overtopping. In addition, the owner should accomplish the following: repair low level outlet, repair downstream wall, remove trees and brush from crest and downstream area, repair concrete at main spillway, replace riprap on upstream slope near main spillway. The owner should also implement a warning system and systematic program of inspection and maintenance.

The recommendations and remedial measures outlined above and in Section 7 should be implemented by the Owner within a period of one year after receipt of this Phase I Inspection Report. In the interim the slide gates should be opened and the pond drained to invert El 567.9. An alternative to these recommendations would be to breach the dam and drain the pond.



Edward M. Greco
Edward M. Greco, P.E.
Project Manager
Metcalf & Eddy, Inc.

Approved by:

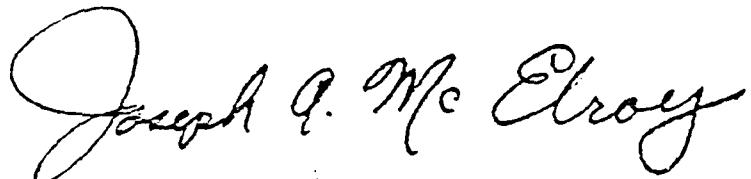
Stephen L. Bishop
Stephen L. Bishop, P.E.
Vice President
Metcalf & Eddy, Inc.

Massachusetts Registration
No. 19703



UPPER STONEVILLE RESERVOIR DAM

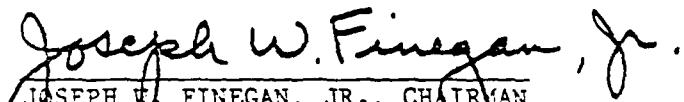
This Phase I Inspection Report on Upper Stoneville Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.



JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

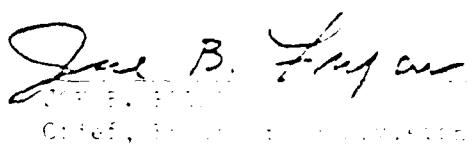


CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division



JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

APPROVAL REQUESTED:



Joe B. Fugue
Chief, Reservoir Control Center

PREFACE

This report is prepared for guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigation. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environmental of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

UPPER STONEVILLE RESERVOIR DAM

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UPPER STONEVILLE RESERVOIR DAM

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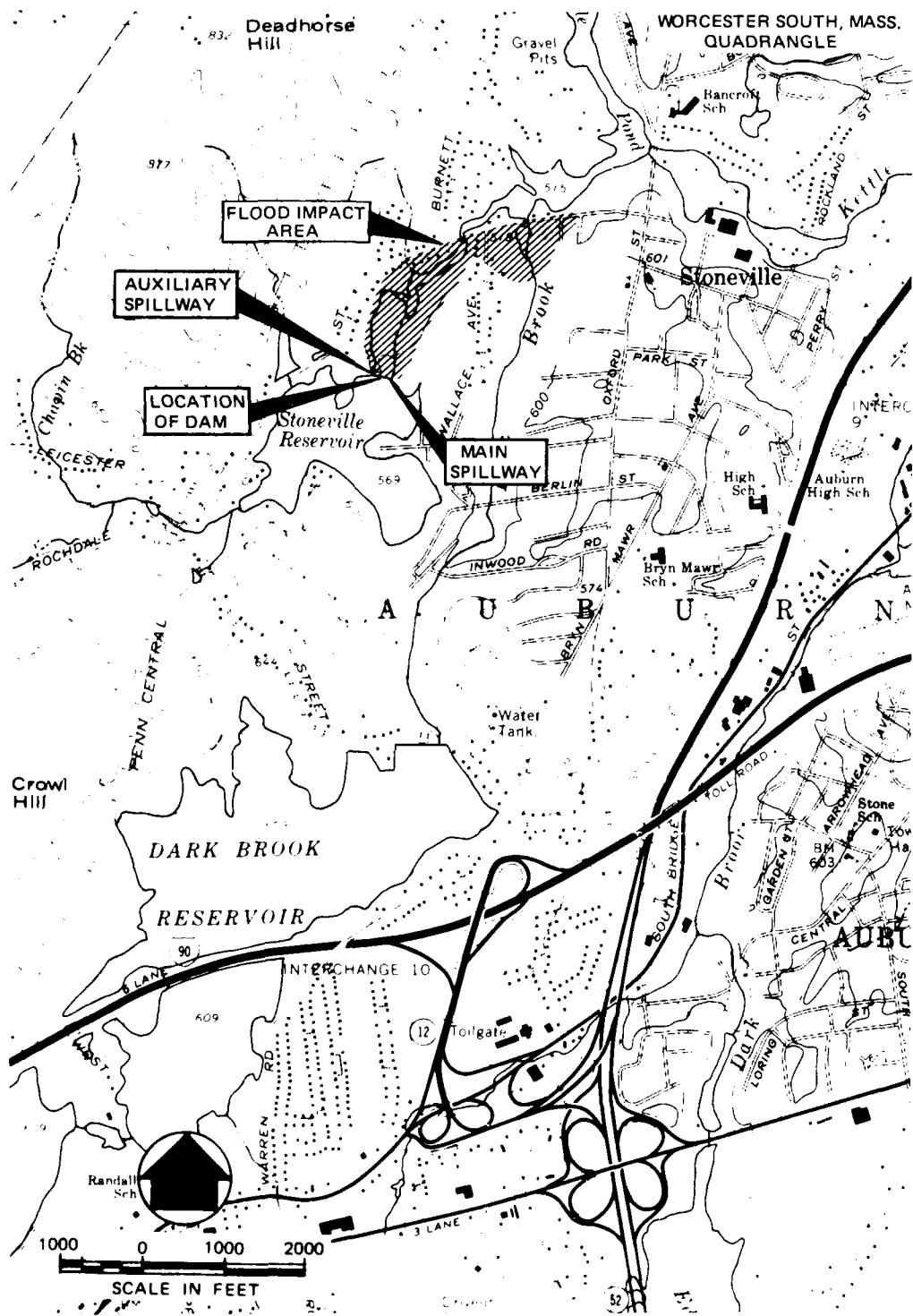
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 NATIONAL INVENTORY OF DAMS

UPPER STONEVILLE RESERVOIR DAM

**OVERVIEW
UPPER STONEVILLE POND DAM
AUBURN, MASSACHUSETTS**





LOCATION MAP – UPPER STONEVILLE RESERVOIR

SECTION 4
OPERATING PROCEDURES

- 4.1 Procedures. During the summer, 2-foot high flashboards are installed with a crest at El 571.0. This is to provide a higher water surface elevation for the Auburn Town Beach. During the spring and fall the two outlet slide gates at the main spillway are opened to lower the Reservoir in anticipation of high runoff.
- 4.2 Maintenance of Dam. Although the Owner visits the site periodically, the dam is not adequately maintained. There is a dense growth of vegetation both on the crest of the dam and along the downstream toe. The downstream dry stone masonry wall is in poor condition with many voids in the wall where smaller cobble size stones have been dislodged. There is severe seepage at the dam.
- 4.3 Maintenance of Operational Facilities. Only the two slide gates at the main spillway are apparently maintained as they are reportedly operated bi-annually. Although the gates are operational, they were leaking severely from the sides and bottom at the time of the inspection.

The low level outlet at the middle of the dam is not maintained and apparently has not been operated with-in the recent past (at least five years). The outlet leaks as water was observed discharging from the pipe.
- 4.4 Description of Any Warning Systems in Effect. There is no warning system in effect at this dam.
- 4.5 Evaluation. There is no regular program of maintenance or warning system in effect at Upper Stoneville Reservoir Dam. This is undesirable considering the dam is in the "high" hazard category. A program of inspection and maintenance and a surveillance system for this dam should be implemented as recommended in Section 7.3.

UPPER STONEVILLE RESERVOIR DAM

A wooden bridge across the auxiliary spillway provides access to the dam. The bridge is in excellent condition.

- d. Reservoir Area. The area immediately adjacent to Stoneville Reservoir is a moderate to highly developed residential area. The least developed areas are wooded and have a slope between 3 and 18 percent.
- e. Downstream Channel. Water over the two spillways flows in separate channels into an upper reach of Stoneville Pond about 1,000 feet downstream of the dam. The discharge channels are shallow, wooded streams with exposed boulders on the bottom. The channel slopes at a gradient of about 6 percent.

3.2 Evaluation. The above findings indicate that the dam is in fair condition, and there are several deficiencies which require attention. It is evident that there has been little maintenance done at the dam. Recommended measures to improve these conditions are stated in Section 7.3.

UPPER STONEVILLE RESERVOIR DAM

the location where the wall reaches its maximum wall height (about 300 feet from the west abutment). About 100 to 200 feet downstream of the east abutment, a swampy area with a considerable water surface was observed. This could be a possible location of seepage.

c. Appurtenant Structures. Both the main and auxiliary spillways appeared in fair to good condition. The concrete was sound at the main spillway although some minor spalling and efflorescence were noted at the walls. The ogee section of the spillway was slightly pitted. The concrete at the auxiliary spillway was in generally good condition although the weir was pitted. There were no flashboards in place at the main spillway while the flashboards at the auxiliary spillway, consisting of 18-inch high frame and plywood panels, were in poor condition. The flashboards were supported to the frames by steel pins.

The dry stone masonry training walls at the auxiliary spillway were in fair condition as many voids and loose stones were observed. There was also a log boom laying across the auxiliary spillway to prevent debris from reaching the spillway. The approaches to both spillways were in fair condition at the time of the inspection. Leaves and a few tree limbs had accumulated at the crest of the spillway.

The slide gates at the main spillway were in operable condition according to the owner. The stems and operators for the gates, which were in good condition, were enclosed in a locked gate house. Both gates were leaking severely from the bottom and sides. Possibly some debris prevented fully closing the gates. The concrete at the outlet showed some minor spalling.

The low level outlet at the middle of the dam, consists of a 15-inch diameter cast iron pipe. The outlet valve was leaking approximately 2 to 5 gallons per minute. The valve for the outlet has not been operated for at least the past five years and was not operational for this inspection. The concrete portion of the gate house was in poor condition although the stone masonry wall appeared in good condition.

UPPER STONEVILLE RESERVOIR DAM

SECTION 3
VISUAL INSPECTION

3.1 Findings

- a. General. The Phase I Inspection of the dam at Upper Stoneville Reservoir was performed on November 16, 1978. A copy of the inspection checklist is included in Appendix A. Previous inspections of the dam have been made by others since 1925. An inspection was made in September, 1976, by the Massachusetts Department of Public Works. A copy of that report is included in Appendix B.
- b. Dam. Upper Stoneville Reservoir Dam consists of an earthfill section with a downstream vertical dry stone masonry wall. An auxiliary spillway is located at the west (left) abutment while the east (right) abutment adjoins natural ground. The main spillway was constructed within natural ground 100 feet east of the east abutment. The crest of the dam is generally level at about El 574.5+. The width of the crest averages 25 feet. The crest is an access road to the spillway and is grass covered with brush growing on the upstream slope and among the stone riprap. Riprap along the upstream face ranged in size from 1 to 2 feet in diameter.

The downstream wall consisting of random sized dry stone masonry was apparently constructed with a slight outward batter. Voids between the large stone are evidence of smaller stones being dislodged throughout the years. A visual inspection of the downstream wall indicated it to be in fair to poor condition. The number of voids in the wall where smaller stones have fallen out indicate areas which should be repaired. Throughout the face of the stone wall, vertical fractures were noted in the stone blocks.

In the downstream area near the east abutment, many cobble size rocks have apparently been dumped. Seepage was noted at approximately

UPPER STONEVILLE RESERVOIR DAM

2.4 Evaluation

- a. Availability. There is limited engineering data available.
- b. Adequacy. The lack of detailed hydraulic, structural, and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based on review of available drawings, visual inspection, past performance history, and engineering judgment.
- c. Validity. Comparison of the available drawings with the field survey conducted during the Phase I inspection indicates that the information is valid.

UPPER STONEVILLE RESERVOIR DAM

SECTION 2
ENGINEERING DATA

2.1 General. There are three drawings dated March, 1950; August, 1955; and November, 1955, available from the Worcester County Commissioners' Office showing proposed reconstruction and additions to the dam (see Appendix B). The 1950 drawing shows proposed reconstruction of the main spillway. The 1955 drawings show plans first for the proposed auxiliary spillway and then for the proposed auxiliary spillway, bridge and abutments. No other plans or specifications are available from the Owner, State, or County relative to the design, construction, or repair of this dam. Hydraulic computations for the auxiliary spillway are included in Appendix D.

We acknowledge the assistance and cooperation of personnel of the Massachusetts Department of Public Works: Messrs. Willis Regan and Raymond Rochford, and of the Massachusetts Department of Environmental Quality Engineering, Division of Waterways: Messrs. John J. Hannon and Joseph Iagallo.

Also, we acknowledge the cooperation and assistance of personnel from the Worcester County Engineer's Office: Messrs. John O'Toole and Joseph Brasauskas.

We acknowledge the assistance and cooperation of the Owner, the Massachusetts Electric Company in Worcester, Massachusetts.

2.2 Construction Records. The only construction records are the 1950 and 1955 Plans referred to in Section 2.1 and included in Appendix B. There are no as-built drawings for the dam, spillway or outlet structures.

2.3 Operating Records. No operating records are available, and there is no daily record kept of the elevation of the pool or rainfall at the dam site.

UPPER STONEVILLE RESERVOIR DAM

J. Regulating Outlets. There are three regulating outlets at the dam. At the abutment of the main spillway are two 2-foot by 2-1/2-foot slide gates which are operated by hand cranks and mechanical operators, located in a locked control structure. These gates are normally operated twice a year. The invert of the gates is at El 567.9. A third outlet, which has not been operated within at least the past five years, according to the owner, is located within the embankment approximately midway between the two spillways. The outlet pipe is 15 inches in diameter with the invert at the discharge end of El 558.6. A mechanical operator with a hand crank is located within a locked structure.

UPPER STONEVILLE RESERVOIR DAM

(5) Spillway crest: 64

g. Dam

- (1) Type: earthfill
- (2) Length: 420 feet
- (3) Height: 15 feet
- (4) Top width: 25 feet
- (5) Side slopes: 2-1/2 (horizontal) to 1 (vertical); downstream - vertical wall
- (6) Zoning: Unknown
- (7) Impervious core: Unknown (although past inspection report indicates plank core wall present)
- (8) Cutoff: Unknown
- (9) Grout curtain: Unknown

i. Spillway

- (1) Type: (Main) ogee
(Auxiliary) broad-crested
- (2) Length of weir: (Main) 15 feet
(Auxiliary) 25 feet
- (3) Crest elevation: (Main) 569.0 (assumed benchmark) (Auxiliary) 569.7
Both without flashboards
- (4) Gates: None
- (5) Upstream channel: (Main) gravel bottom - concrete side walls
(Auxiliary) stone paving, dry stone masonry side walls
- (6) Downstream channel: (Main) channel cut in natural ground
(Auxiliary) stone paving to natural ground

UPPER STONEVILLE RESERVOIR DAM

- (4) Full flood control pool: Not Applicable
(N/A)
- (5) Recreation pool: 569.0 (without
flashboards) 571.0 (with flashboards)
- (6) Spillway crest (ungated): 569.0 (main
spillway) 569.7 (auxiliary spillway)
- (7) Upstream portal invert diversion tunnel:
N/A
- (8) Stream bed at centerline of dam: 558.6
- (9) Maximum tailwater: N/A

d. Reservoir

- (1) Length of maximum pool: 2,400 feet
- (2) Length of recreation pool: 2,400 feet
- (3) Length of flood control pool: N/A

e. Storage (acre-feet)

- (1) Test flood surcharge (net): 325 at El
574.1
- (2) Top of dam: 775
- (3) Flood control pool: N/A
- (4) Recreation pool: 500 (Approximate)
- (5) Spillway crest: 500

f. Reservoir Surface (acres)

- *(1) Top dam: 64
- *(2) Test flood pool: 64
- (3) Flood-control pool: N/A
- (4) Recreation pool: 64

*Based on the assumption that the surface area will not
increase significantly with changes in reservoir eleva-
tion from 573.3 to 574.1.

UPPER STONEVILLE RESERVOIR DAM

be drumlins. Residential areas occur mainly along Rochdale and Leicester Streets with sparse development along Stafford and Auburn Streets.

b. Discharge. Normal discharge is over the main and auxiliary spillways. The crest of the main spillway is at El 569.0 while the crest of the auxiliary spillway is at El 569.7. The entire main spillway from side wall to side wall is 29 feet. However, a gate house in the spillway reduces the effective length of the weir to 15 feet. The main spillway is a concrete ogee weir approximately 9 feet high from crest to channel bottom. The auxiliary spillway is about 25 feet long and consists of a flat weir which gently slopes to the bottom of the stream channel. The spillway is about 8-1/2 feet high from the crest to the bottom of the channel.

Water from both spillways flows in nearly parallel channels about 1,000 feet downstream to Stoneville Pond. The area surrounding the discharge channel is wooded and slopes down to Stoneville Pond at about a 6 percent grade.

Without flashboards the main spillway will discharge 410 cfs while the auxiliary spillway will discharge 530 cfs with a water surface at El 573.3 which is the low point on the crest of the dam. The effect of flashboards will be to reduce the capacities. At the same water elevation the slide gates will discharge 100 cfs. Under one-half the PMF the dam will be overtopped by 0.8 feet with water surface at El 574.1.

c. Elevation (feet above Mean Sea Level (MSL)). A benchmark at El 569.0 was established at the main spillway crest. This elevation was based upon United States Geological Survey (USGS) topographic map (1973) water surface elevation for Stoneville Reservoir (see Figure B-1).

(1) Top dam: 573.3 to 574.7.

(2) Test flood pool: 574.1

(3) Design surcharge: Unknown

UPPER STONEVILLE RESERVOIR DAM

outlet gates at the main spillway can be opened by hand cranks and mechanical operators located within a locked structure on the crest of the dam next to the spillway. A low level outlet near the center of the dam has not been operated in the recent past (five years).

- g. Purpose of Dam. Water is stored in the Reservoir for recreational use. The Auburn Town Beach is located on the shores of the Reservoir. The water within the reservoir is not required by the owner for any purpose.
- h. Design and Construction History. Available records do not indicate the date of construction of the dam, but it is assumed the dam was constructed during the late 1800's. Records of past inspections reports indicate repairs and additions have been made periodically. Drawings, received from the Worcester County Engineering Department and included in Appendix B, show repairs proposed to the main spillway in 1949 and plans for a new auxiliary spillway in 1955. The proposed repairs appear to have been implemented at the main spillway and the auxiliary spillway was constructed generally in accordance with the plans. Past inspection reports indicate that a plank core wall is located within the embankment of the dam. At various times, leaking through the downstream wall has been reported. Leaks were periodically noted in past inspection reports.
- i. Normal Operating Procedures. The top of the flashboards are set at El 571.0 throughout the summer. The water level is maintained for recreational use. During the spring and fall, the flashboards are removed from the main spillway and the slide gates are opened to lower the water level about 1.5 feet.

1.3 Pertinent Data

- a. Drainage Area. The approximately 1,709-acre (2.67 square mile) drainage area includes numerous swamps, brooks, and small un-named ponds in both Auburn and Leicester, Massachusetts. The area is largely undeveloped, wooded and swampy. Within the drainage area are several elongated hills which appear to

UPPER STONEVILLE RESERVOIR DAM

spans the auxiliary spillway. The abutments for the bridge, which also form part of the sidewall, are concrete.

Water flows over the spillway in a shallow, tree covered and boulder laden stream channel, which approximately parallels the channel from the main spillway. The flow eventually reaches Stoneville Pond without joining flow from the other spillway.

Flashboards which are installed on the auxiliary spillway consist of 2 by 4-inch wood frame and plywood panels. The flashboards are 18 inches high.

A low level outlet, consisting of a 15-inch cast iron pipe, penetrates the embankment at approximately the midpoint of the dam. The invert of the pipe is at El 558.6. A locked gate house enclosing the valve stem is located on the crest of the dam.

- c. Size Classification. Upper Stoneville Reservoir Dam is classified in the "small" category since it has a maximum height of 15 feet and a maximum storage capacity of 775 acre-feet.
- d. Hazard Classification. Downstream of Stoneville Reservoir is an upper reach of Stoneville Pond. Adjacent to this area are Rockdale Street and Wallace Avenue. Several residences are located in this area which would be impacted by a failure of the Upper Stoneville Reservoir Dam. The residences are about 1,400 feet downstream of the dam. Accordingly, because of the possible loss of more than a few lives, the dam has been placed in the "high" hazard category.
- e. Ownership. The dam is owned by the Massachusetts Electric Company, 939 Southbridge Street, Worcester, Massachusetts 01610. Mr. Barry Huston, District Superintendent (617-791-8511) granted permission to enter the property and inspect the dam.
- f. Operators. The dam is operated by personnel of the Massachusetts Electric Company. The

UPPER STONEVILLE RESERVOIR DAM

the Town of Auburn, Worcester County, Massachusetts (see Location Map and Drainage Area Map).

b. Description of Dam and Appurtenances. Upper Stoneville Reservoir Dam consists of an earth-fill section with a downstream vertical dry stone masonry wall (see Figures B-1 and B-2). The crest of the dam which is about 25 feet wide is grass covered. The crest of the dam varies between El 573.3 to El 574.7. The upstream face has a 2-1/2 (horizontal) to 1 (vertical) slope with stone riprap protection ranging in size from 1 to 2 feet. Brush and grass cover most of the upstream slope. The length of the dam is about 420 feet with a slight bend at the east end where it ties into natural ground at the right abutment. An auxiliary spillway is located near the west (left) abutment. The main spillway is located in natural ground about 100 feet east of the east (right) abutment of the dam.

The main spillway consists of a concrete ogee section having a maximum height of about 9 feet above the bottom of the downstream channel. The length of the weir is about 15 feet (see Figure B-1). A gate house is located at the crest between the two concrete training walls of the main spillway. Two 2 by 2-1/2-foot slide gates are situated below the gate house. At the time of the inspection, there were no flashboards in place although up to 2 feet of flashboards are reportedly placed on the spillway during the summer. Water over the main spillway flows to Stoneville Pond about 1,000 feet downstream of the dam. The discharge channel is relatively shallow, tree covered and filled with boulders.

The auxiliary spillway, constructed at the west abutment during 1955 consists of a combination 25-foot long, broad-crested, stone paved and concrete weir (see Figure B-1). Downstream from the crest of the spillway is a 7-foot long concrete apron and then 14 feet of stone paving. The slope of this section is 9 (horizontal) to 1 (vertical). The sidewalls of the spillway on both the upstream and downstream side are stone faced. A wooden bridge

UPPER STONEVILLE RESERVOIR DAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

UPPER STONEVILLE RESERVOIR

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Contract No. DACW 33-79-C-0016, dated November 28, 1978, has been assigned by the Corps of Engineers for this work.

b. Purpose

- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
- (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
- (3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. The dam is located on Chapin Brook, a tributary of the Blackstone River in

UPPER STONEVILLE RESERVOIR DAM

SECTION 5
HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

- a. General. Drainage to Stoneville Reservoir originates principally in wooded hills and swamps to the west of the reservoir. The drainage area consists of about 1,709 acres (2.67 square miles). Water flows from Stoneville Reservoir into Stoneville Pond. The dam at Stoneville Reservoir is an earthfill dam with vertical downstream dry stone masonry walls. The weir of the main spillway at the dam is about 15 feet long with a crest at El 569.0. The main spillway was excavated into natural ground 100 feet east of the east abutment. An auxiliary spillway having a 25-foot long weir at El 569.7 was constructed at the west abutment of the dam. Each spillway has provision for about 2 feet of flashboards. The low area between the right abutment of the dam and main spillway at which overtopping would occur is 573.3. Two operable slide gates and a low-level outlet provide emergency discharge outlets.
- b. Design Data. There are no hydraulic computations available for this dam except for the computations of the auxiliary spillway. The maximum design flow is unknown.
- c. Experience Data. Hydrologic records are not available for this dam. The dam has apparently not been overtopped in the past according to previous inspection reports. A trench was cut in the "north end" of the embankment to prevent overtopping in 1936. The present owner did not know if the dam had been overtopped in either 1938 or 1955.
- d. Visual Observations. Both spillways appear in fair to good condition. Minor efflorescence and spalling was noted. The flashboards had been removed from the main spillway but were in place at the auxiliary spillway. The approach and discharge channels were not clogged but there were leaves, small trees and boulders in the discharge channel.

UPPER STONEVILLE RESERVOIR DAM

e. Test Flood Analysis. The Probable Maximum Flood (PMF) rate was determined to be 1,550 cfs per square mile. This calculation is based on the average slope of the drainage area of 3 percent, the pond-plus-swamp area to drainage area ratio of 10 percent, and the U.S. Army Corps of Engineers' guide curves for Maximum Probable Flood Peak Flow Rates (dated December 1977). Applying one-half the PMF to the 2.67 square miles of drainage area results in a calculated peak flood flow of 2,100 cfs as the inflow test flood. By adjusting the inflow test flood for surcharge storage, the maximum discharge rate was established as 1,590 cfs (600 cfs per square mile), with a water surface at El 574.1. This analysis assumes all flashboards have been removed.

Hydraulic analyses indicate that both spillways and outlet could discharge 1,040 cfs or 65 percent of the test flood when the water surface is at El 573.3 which is the low elevation on the crest of the dam. Both spillways, with outlet closed, can discharge 940 cfs or 59 percent of the test flood. These discharges are less than the outflow test flood of 1,590 cfs and therefore the dam would be overtopped by about 0.8 feet.

f. Dam Failure Analysis. Based on a possible failure of the dam with the water surface at El 573.3, the peak discharge flood flow would be about 7,600 cfs. It is probable that several residences (less than 10) could be flooded along Rochdale Street, particularly at the Burnett Street intersection. Rochdale Street as it crosses Stoneville Pond would probably be overtopped.

At El 573.3 the auxiliary spillway would be discharging 530 cfs. This would result in a depth of water in the west discharge channel of 3.6 feet. Failure of the dam would produce a surcharge height in the channel of 6 feet for a total depth of 9.5 feet.

UPPER STONEVILLE RESERVOIR DAM

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observations. The evaluation of the structural stability of Upper Stoneville Reservoir Dam is based on a review of available drawings and the visual inspection conducted on November 16, 1978. A detailed discussion of the visual inspection appears in Section 3, Visual Inspection. Based on this inspection, the dam is judged to be in fair condition. Those factors which are considered of major importance to the stability of the dam include the seepage under the toe of the downstream wall, poor condition of the downstream wall due to the voids, and vertical fractures in the stone masonry. Seepage at the toe has been noted in previous inspection reports performed by others.
- b. Design and Construction Data. Discussions with the Owner, County, and State personnel indicate that there are no available plans, specifications or computations on the design and construction of the dam.

Drawings of the reconstruction of the main spillway and construction of a storm spillway are available and included in Appendix B.

Information does not appear to exist on the type, shear strength, and permeability of the soil and/or rock materials of the embankment.
- c. Operating Records. There is no instrumentation of any type in Upper Stoneville Reservoir Dam, and no instrumentation was ever installed in this dam. The performance of this dam under prior loading can only be inferred by physical evidence at the site.
- d. Post-Construction Changes. There are no as-built drawings available for the Upper Stoneville Reservoir Dam. Based on visual evidence and field measurements during the inspection, the spillways appear to have been constructed as shown on the drawings included in Appendix B.

UPPER STONEVILLE RESERVOIR DAM

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition. Based upon a visual inspection of the dam, there are several deficiencies which should be corrected to assure the continued performance of the dam. The observed seepage under the toe of the wall should be investigated. The downstream masonry wall should be repaired and the cause of the fracturing of the stone blocks investigated. The leaking gates at the main spillway should be repaired and valve at the low-level outlet should be made operational. The brush and trees should be cut down and maintained along the crest and at the downstream toe. The swampy, wet area about 50 feet downstream of the dam should be monitored for possible flow.

Hydraulic analyses indicate that the two spillways can discharge a flow of 940 cfs at El 573.3. An outflow test flood discharging at 1,590 cfs (assuming both gates and low-level outlet open) will overtop the dam by about 0.8 feet. Generally, the dam is considered in fair condition.

- b. Adequacy. The lack of detailed design and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based primarily on review of available drawings, visual inspection, past performance and engineering judgment.
- c. Urgency. The recommendations and remedial measures outlined below should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.
- d. Need for Additional Investigation. Additional investigations to further assess the adequacy of the dam are outlined below in Section 7.2 Recommendations.

UPPER STONEVILLE RESERVOIR DAM

7.2 Recommendations. In view of the concerns over the continued performance of the dam established by this report, it is recommended that the Owner employ a qualified consultant to evaluate raising the embankment to prevent overtopping, the seepage at the downstream toe and fracturing of the stone in the downstream masonry wall.

Recommendations on repairs and maintenance procedures are outlined below under Section 7.3, Remedial Measures.

7.3 Remedial Measures

Operating and Maintenance Procedures. The dam and appurtenant structures are not adequately maintained. It is recommended that the Owner:

- (1) open both slide gates and drain the pond to invert El 567.9 until all the recommendations and remedial measures have been implemented.
- (2) insure that the low-level outlet is operational;
- (3) repair the downstream masonry wall after conducting the investigation recommended above;
- (4) selective removal of trees and brush from the crest, upstream slope and downstream area of the dam and fill resulting excavations;
- (5) repair the concrete along the spillway and gate house to prevent further deterioration;
- (6) maintain the spillways and discharge channels free from accumulated debris;
- (7) replace riprap on upstream embankment between the dam and main spillway;
- (8) implement a systematic program of maintenance inspections. As a minimum, the inspection program should consist of a

UPPER STONEVILLE RESERVOIR DAM

monthly inspection of the dam and appurtenances, supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in accordance with all applicable State regulations;

- (9) periodic technical inspections of this dam should be continued on an annual basis;
- (10) institute a definite plan for surveillance and a warning system during periods of unusually heavy rains and/or runoff.

7.4 Alternatives. An alternative to implementing the recommendations listed above and the maintenance procedures itemized would be to breach the dam and drain the reservoir. This may be undesirable since the Town of Auburn relies on the impounded water for recreational purposes.

UPPER STONEVILLE RESERVOIR DAM

APPENDIX A

PERIODIC INSPECTION
CHECKLIST

UPPER STONEVILLE RESERVOIR DAM

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT UPPER STONEVILLE DAMDATE Nov. 16, 1978TIME 8:00AM-12:00 NoonWEATHER Cool clearW.S. ELEV. 569.08 U.P.Assumed benchmark El.569
on spillway crest

PARTY:

1. R. Weber
2. H. Lord
3. D. Cole
4. W. Checchi
5. E. Greco

6. L. Branagan
7. _____
8. _____
9. _____
10. _____

PROJECT FEATURE

INSPECTED BY

REMARKS

Dam Embankment

R. Weber / E. Greco

Spillway

R. Weber / L. Branagan

PERIODIC INSPECTION CHECK LIST

PROJECT UPPER STONEVILLE DAM DATE Nov. 16, 1978
 PROJECT FEATURE Dam NAME R. Weber/
 DISCIPLINE Geotechnical NAME _____

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	Varies from El. 574.4 to El. 574.7
Crest Elevation	
Current Pool Elevation	569.08
Maximum Impoundment to Date	Unknown
Surface Cracks	None visible
Pavement Condition	Gravel crest with vegetation
Movement or Settlement of Crest	None visible
Lateral Movement	None visible
Vertical Alignment	Slight outward batter of downstream wall
Horizontal Alignment	One bend in wall
Condition at Abutment and at Concrete Structures	Good, dam abuts natural ground at both ends
Indications of Movement of Structural Items on Slopes	None visible
Trespassing on Slopes	Wheeled vehicles
Sloughing or Erosion of Slopes or Abutments	None visible
Rock Slope Protection - Riprap Failures	12 Inch to 24 inch size, fair condition, missing near spillway.
Unusual Movement or Cracking at or near Toes	Randomly located fractures in downstream wall, many voids, wall in poor repair
Unusual Embankment or Downstream Seepage	Seepage at toe of wall at approx. highest point
Piping or Boils	None visible
Foundation Drainage Features	Unknown
Toe Drains	Unknown
Instrumentation System	Unknown

PERIODIC INSPECTION CHECK LIST

PROJECT UPPER STONEVILLE DAM
 PROJECT FEATURE Control tower at Spillway
 DISCIPLINE Geotechnical

DATE Nov. 16, 1978
 NAME R. Weber
 NAME _____

AREA EVALUATED	CONDITION
<u>CUTLET WORKS - CONTROL TOWER</u>	
a. Concrete and Structural	
General Condition	Fair
Condition of Joints	Good
Spalling	Minor in areas
Visible Reinforcing	None
Rusting or Staining of Concrete	None
Any Seepage or Efflorescence	None visible
Joint Alignment	Good
Unusual Seepage or Leaks in Gate	2 Slide gates leak
Cracks	Some cracks
Rusting or Corrosion of Steel	None visible
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

PERIODIC INSPECTION CHECK LIST

PROJECT UPPER STONEVILLE DAM DATE Nov. 16, 1978
 Control Tower
 PROJECT FEATURE Within Embankment NAME R. Weber
 DISCIPLINE Geotechnical NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	
a. Concrete and Structural	
General Condition	Fair to poor
Condition of Joints	Fair
Spalling	Major in areas
Visible Reinforcing	None
Rusting or Staining of Concrete	None
Any Seepage or Efflorescence	None visible
Joint Alignment	-
Unusual Seepage or Leaks in Gate	Apparent leak in gate of outlet pipe
Cracks	Major cracks
Rusting or Corrosion of Steel	None
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

PERIODIC INSPECTION CHECK LIST

PROJECT UPPER STONEVILLE DAMDATE Nov. 16, 1978PROJECT FEATURE Outlet Conduit
Within EmbankmentNAME R. WeberDISCIPLINE Geotechnical

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	N/A
Rust or Staining	N/A
Spalling	N/A
Erosion or Cavitation	N/A
Visible Reinforcing	N/A
Any Seepage or Efflorescence	2-5 gpm seepage estimated through outlet pipe
Condition at Joints	N/A
Drain Holes	N/A
Channel	Stone masonry, very poor condition
Loose Rock or Trees Overhanging Channel	Small brush in channel
Condition of Discharge Channel	Very poor condition-debris in channel, trash rack downstream

PERIODIC INSPECTION CHECK LIST

PROJECT UPPER STONEVILLE DAM
 PROJECT FEATURE Outlet Conduit at Spillway
 DISCIPLINE Geotechnical

DATE Nov. 16, 1978
 NAME R. Weber
 NAME _____

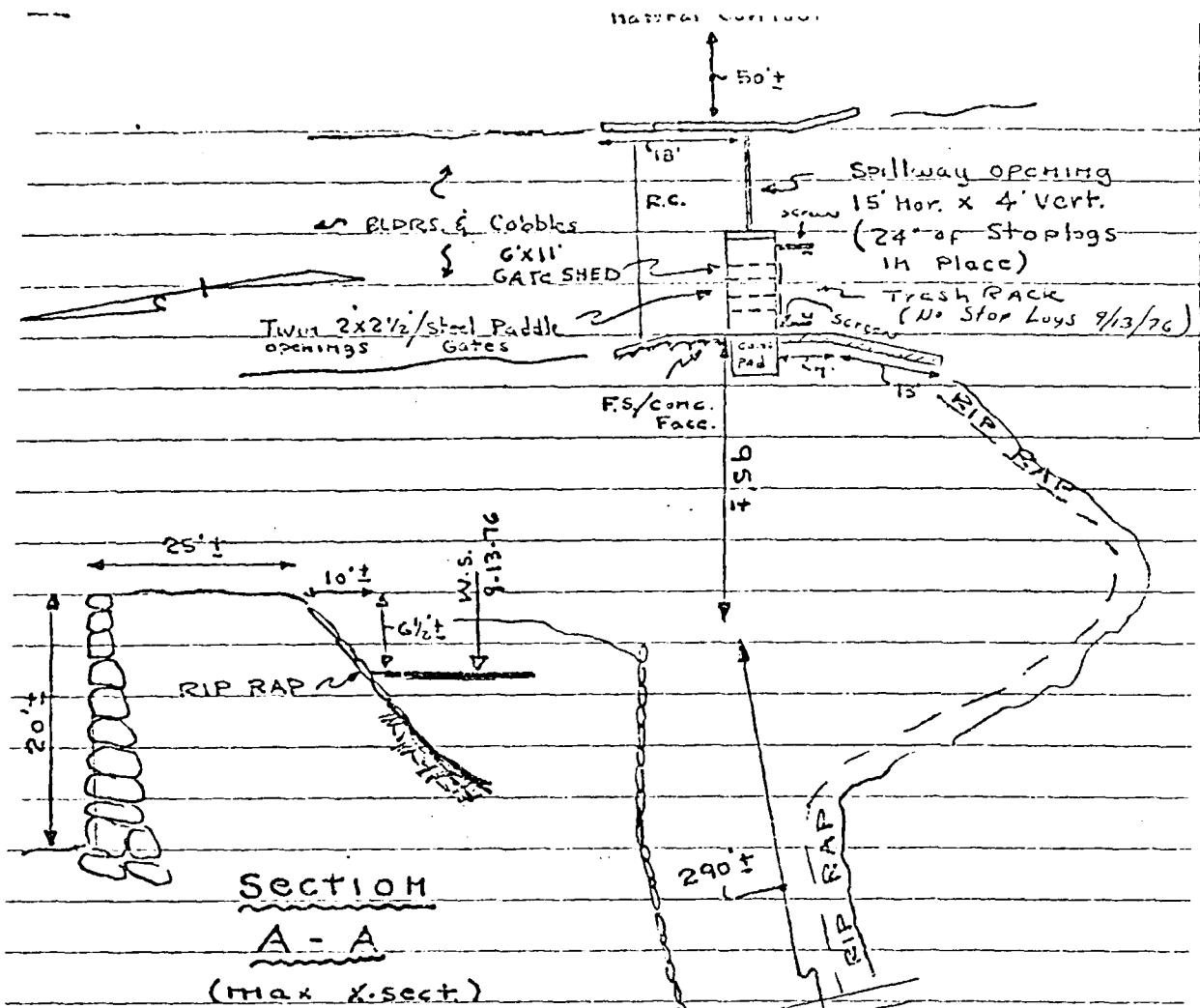
AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	<u>Fair to poor</u>
<u>General Condition of Concrete</u>	
<u>Rust or Staining</u>	<u>None visible</u>
<u>Spalling</u>	<u>Minor in some places</u>
<u>Erosion or Cavitation</u>	<u>At inlet</u>
<u>Visible Reinforcing</u>	<u>None visible</u>
<u>Any Seepage or Efflorescence</u>	<u>2 Slide gates leak badly from sides and bottom</u>
<u>Condition at Joints</u>	<u>N/A</u>
<u>Drain Holes</u>	<u>N/A</u>
<u>Channel</u>	<u>Discharge to natural stream Stone and debris in channel</u>
<u>Loose Rock or Trees Over-hanging Channel</u>	<u>Some trees to 12 inches</u>
<u>Condition of Discharge Channel</u>	<u>Fair</u>

PERIODIC INSPECTION CHECK LIST

PROJECT UPPER STONEVILLE DAM
 PROJECT FEATURE Main Spillway
 DISCIPLINE Geotechnical

DATE Nov. 16, 1978
 NAME R. Weber /L. Branagan
 NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Some smaller trees-many leaves at spillway.
Floor of Approach Channel	Fair - mostly submerged
b. Weir and Training Walls	
General Condition of Concrete	Walls fair Weir eroded on surface Some rust stains along training wall
Rust or Staining	Some rust stains along training wall
Spalling	Minor-some cracks in wall
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Very minor efflorescence
Drain Holes	None visible
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Some trees
Floor of Channel	Stone and some debris
Water Intrusions	None

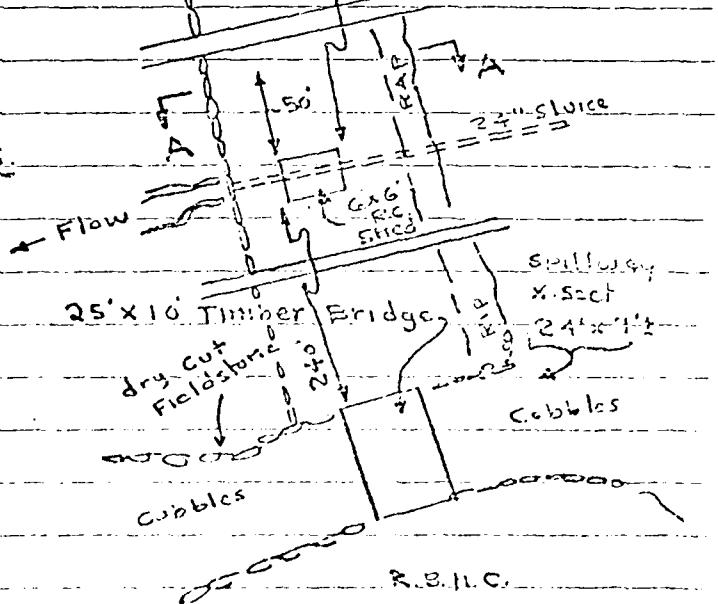


AUBURN

Upper STONEVILLE Res.

AM No. 3-14-17-02

SKETCH #1



THE NEW YORK STATE LIBRARY

12. Remarks & Recommendations: (Fully Explain)
the downstream wall is in fair to good condition - It hasn't been moved much by weathering. The only notable thing wrong with this wall is a $3/4$ x C.Y. cavity 100' West of its Easterly extremity. There is a significant amount of standing water beyond the downstream toe - No visible motion, but upper pool elevation is 3'-4' below normal - Most of this was noted to the right of the 24" sluice pipe discharge end. Since a condition such as this should be monitored for significant change, the heavy growth of trees & brush there should be removed so as to facilitate visual inspections.

The condition of the sluice is indeterminate. The ^{large end appears to be in fair condition, and therefore no embankment depression noted} ~~large end appears to be in fair condition, and therefore no embankment depression noted~~ ^{be due to the age of the dam, I would surmise that the 24" C.I.} sleeve by an older stone sluice box. In any event, it is the owners responsibility to make certain that the sluice is in good condition. Failure of a sluice in an earth core dam (with a 5' head) has the potential of causing a rapid dam failure.

The West Spillway is in fair condition, except that the downstream portion of the Westerly Check wall could use some restoration. Some embankment areas adjacent to the Easterly Spillway have sustained surface erosion and localized loaming & seeding is warranted.

13. Overall Condition:

1. Safe _____
- * 2. Minor repairs needed So far as can be determined from a visual inspection _____
3. Conditionally safe - major repairs needed _____
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain)
Recommend removal from inspection list _____

* Note (13-2): Owner should be told to periodically check pools of standing water @ D.S. toe for significant change (i.e. piping, migration of core material etc.) and have consultant inspection conducted if said changes occur.

8. Downstream Face of Dam:

Condition: 1. Good _____ 2. Minor Repairs _____
3. Major Repairs 4. Urgent Repairs _____
^{To}

Comments: See 12 - REMARKS - Page 3

9. ^{East}
Emergency Spillways:

Condition: 1. Good _____ 2. Minor Repairs _____
3. Major Repairs _____ 4. Urgent Repairs _____

Comments: Repair debris screen assembly (As per 6)
Concrete - Surface SPALLING - Could use MINOR
POINTING UP

For West Spillway, See 12 - Remarks - Page 3
10. Water Level at time of inspection: 6 1/2 ft. above _____ below _____

top of dam main embankment principal spillway _____

other _____

11. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment U.S. Face _____

Animal Burrows and Washouts _____

Damage to slopes or top of dam _____

Cracked or Damaged Masonry MINOR SURFACE SPALLING _____

Evidence of Seepage _____

Evidence of Piping Indeterminate - Pond below normal water level
Check @ Higher Pool Level

Erosion (see 12) See Attached Sketch)

Leaks _____

Trash and/or debris impeding flow _____

Clogged or blocked spillway _____

Other _____

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town AUBURN Dam No. 3-14-17-02Name of Dam Upper Stowerville Inspected by Regan
Reservoir Date of Inspection 9/13/762. Owner/s: per: Assessors _____ Prev. Inspection
Reg. of Deeds _____ Pers. Contact _____1. Mass. Electric Co. 939 Southbridge St. Worcester, Mass.
Name St. & No. City/Town State Tel. No.

2. _____ Name St. & No. City/Town State Tel. No.

3. _____ Name St. & No. City/Town State Tel. No.

3. Caretaker (if any) e.g. superintendent, plant manager, appointed
by absentee owner, appointed by multi owners.

Name: St. & No.:

City/Town: State: Tel. No.:

4. No. of Pictures taken _____

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate _____3. Severe To 4. Disastrous _____

* This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual Operative yes; _____ No. _____Comments: one of the 2'x 1 1/2" steel paddles @ the East Spillway
is blocked by a piece of debris. Can't be closed. The trash rack
assembly in front of these 2'x 2 1/2" openings needs 2 new "U" channels, new
fenders and new side screws.

7. Upstream Face of Dam: Conditions:

1. Good _____ 2. Minor Repairs

3. Major Repairs _____ 4. Urgent Repairs _____

Comments: Remove heavy growth of brush on Rip Rap
& top of slope.

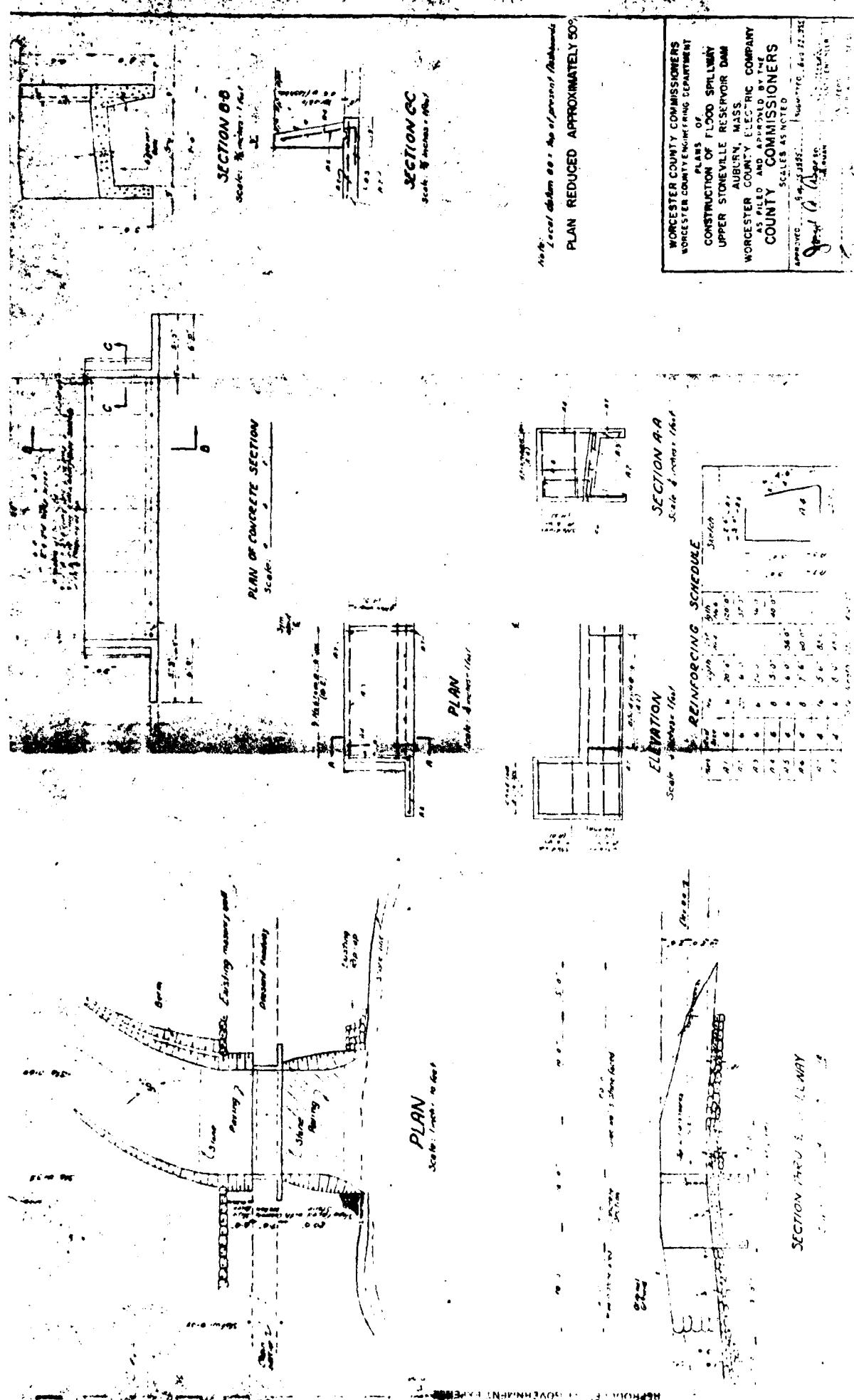
Owner - Miss. Ettrick C
939 SOUTH RD.
Upper Reservoir, Westfield

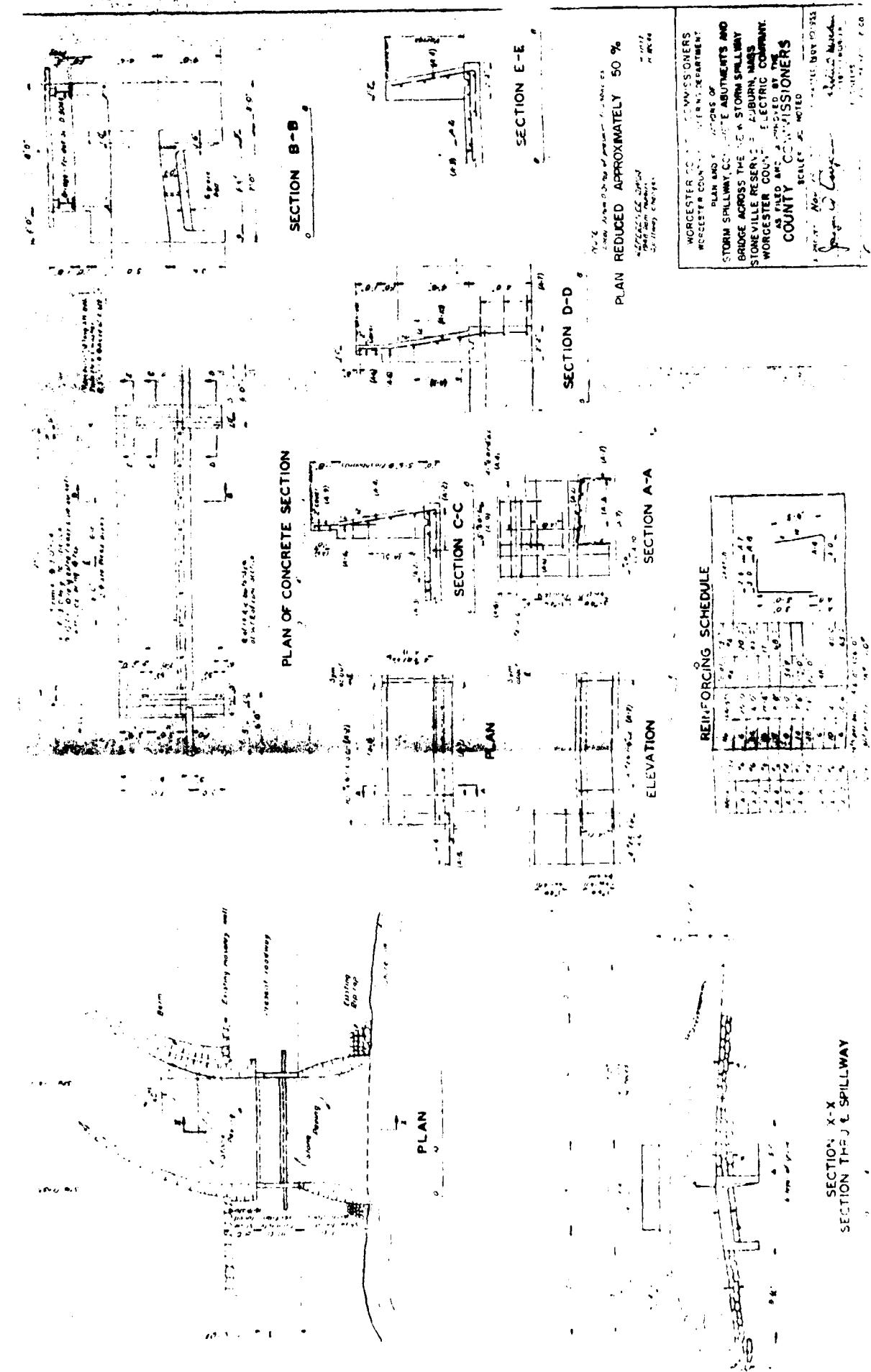
Inspector - 12/14/71 - Michael S. and

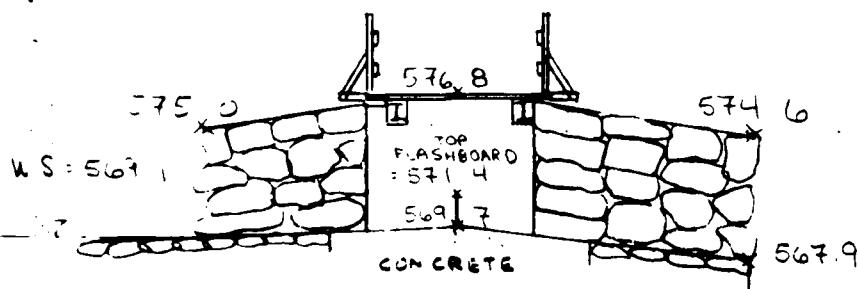
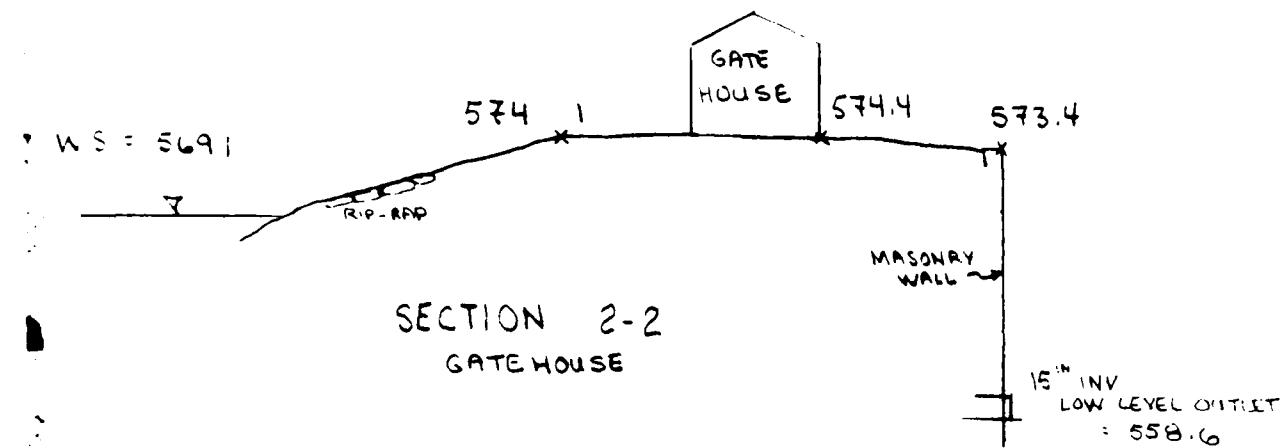
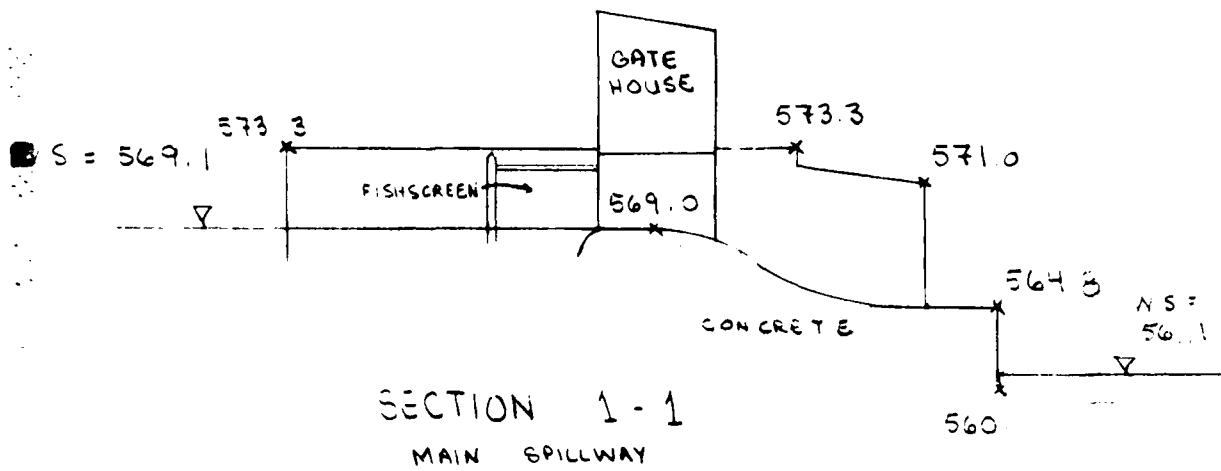
(b3)
17-02

PREVIOUS INSPECTIONS (PARTIAL LISTING)

COPY OF INSPECTION CARD ON FILE AT THE MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS, DISTRICT OFFICE, WORCESTER.







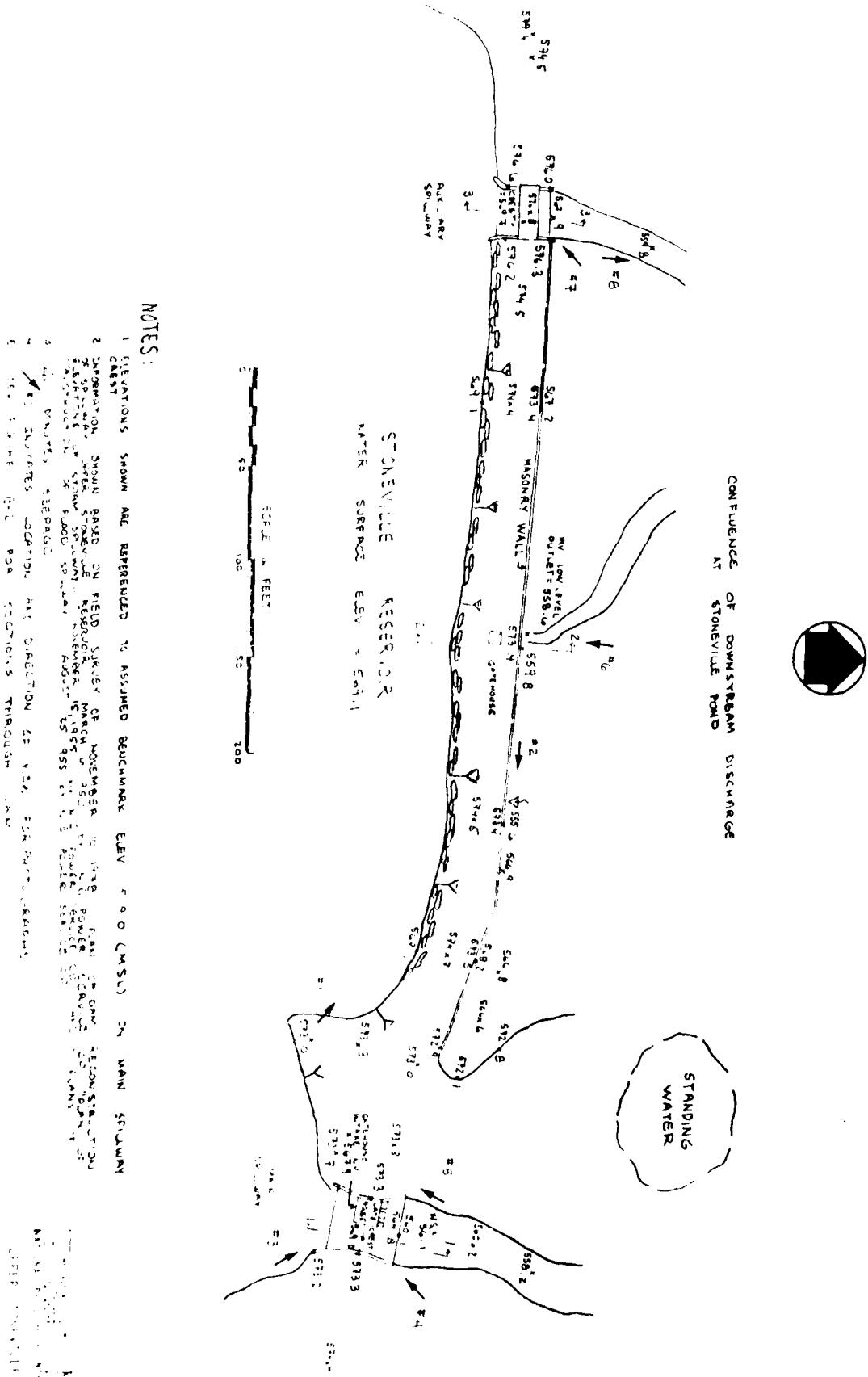
SECTION 3-3
 AUXILIARY SPILLWAY

SCALE IN FEET

1	20	30
---	----	----

METCALF & EDDY, INC. ENGINEERS BOSTON, MA.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MA.
NATIONAL PROGRAM OF INSPECTION OF NON-FED.DAMS	
UPPER STONEVILLE RESERVOIR DAM	
FIGURE B-2 SECTIONS THROUGH DAM	
TRIBUTARY BLACKSTONE RIVER	MASSACHUSETTS
SCALE: 1" = 10'	DATE: JANUARY, 1979

METCALF & EDDY INC



NOTES

APPENDIX B
PLANS OF DAM AND PREVIOUS
INSPECTION REPORTS

	<u>Page</u>
Figure B-1 Plan of Dam	B-1
Figure B-2 Sections Through Dam	B-2
Figure B-3 Reconstruction of Spillway, March, 1950	B-3
Figure B-4 Plan and Elevations of Storm Spillway, Concrete Abutments and Bridge Across the New Storm Spillway	B-4
Figure B-5 Construction of Flood Spillway	B-5
Previous Inspections (Partial Listing)	B-6
Inspection Report, September 13, 1976	B-8
Report on Study Regarding Auxiliary Spillway	B-13

PERIODIC INSPECTION CHECK LIST

PROJECT UPPER STONEVILLE DAM DATE Nov. 16, 1978
 PROJECT FEATURE Bridge NAME R. Weber
 DISCIPLINE Geotechnical NAME

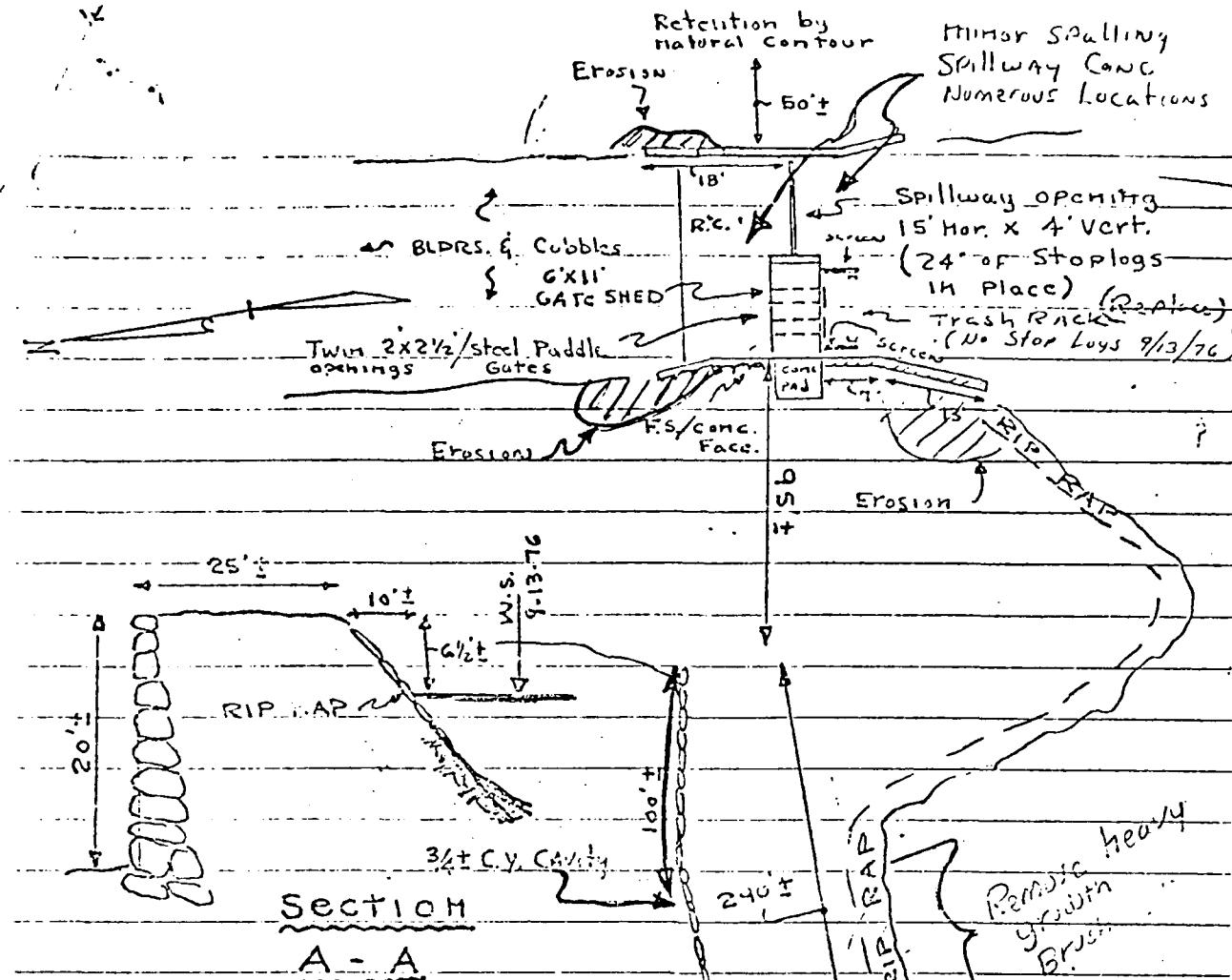
AREA EVALUATED	CONDITION
<u>CUTLET WORKS - SERVICE BRIDGE</u>	
a. Super Structure	
Bearings	Bolted to abutment
Anchor Bolts	-
Bridge Seat	Steel good
Longitudinal Members	Steel "I" beams - good
Under Side of Deck	Excellent treated timber
Secondary Bracing	Steel "I" beams-good
Deck	Timber - excellent
Drainage System	Open deck
Railings	Timber - excellent
Expansion Joints	None
Paint	None
b. Abutment and Piers	
General Condition of Concrete	Excellent
Alignment of Abutment	Perpindicular to dam - good
Approach to Bridge	Gravel
Condition of Seat and Backwall	Good

PERIODIC INSPECTION CHECK LIST

PROJECT UPPER STONEVILLE DAMDATE Nov. 16, 1978PROJECT FEATURE Auxiliary SpillwayNAME R. Weber / L. BranaganDISCIPLINE Geotechnical

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	Fair - has stop log
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Small brush
Floor of Approach Channel	Cluttered with loose boulders, leaves and logs
b. Weir and Training Walls	
General Condition of Concrete	Concrete bridge abutments good Weir-erosion on surface Stone sidewalls - fair with voids
Rust or Staining	Minor on wall
Spalling	None visible
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None visible
Drain Holes	None visible
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	Dumped boulder fill in channel bottom
Trees Overhanging Channel	Small brush
Floor of Channel	Boulders, leaves, logs
Other Instructions	Flashboards in poor condition consist of combination 2"x4" & plywood sheets.



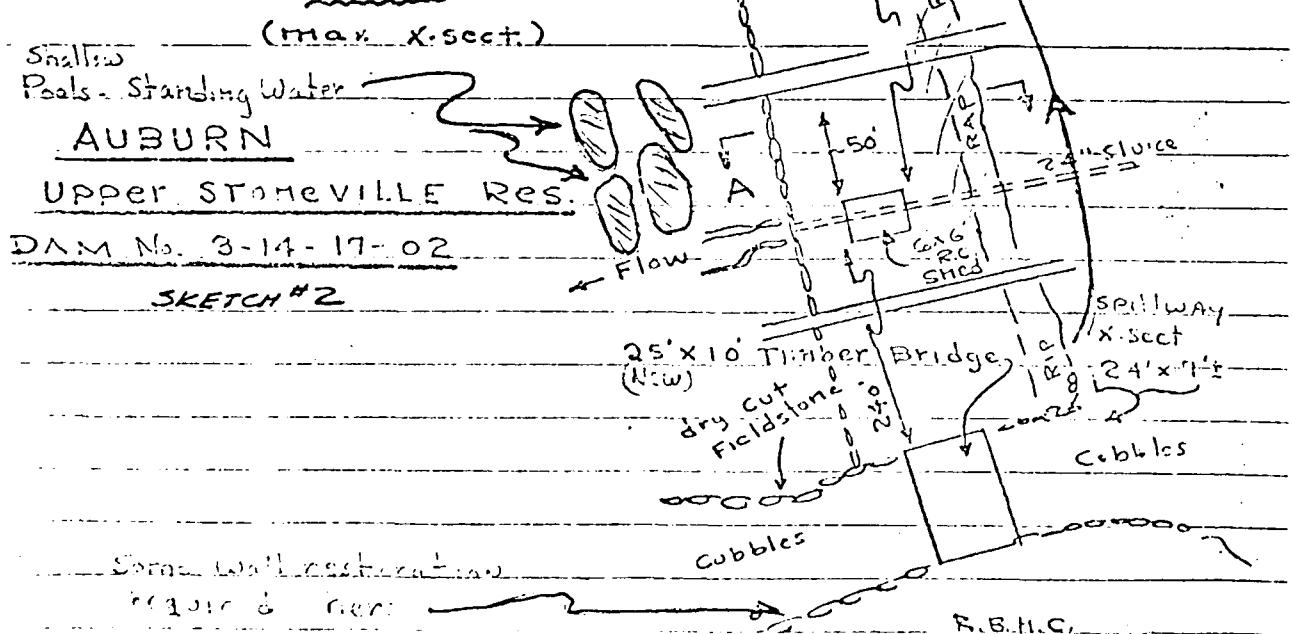
Small: Pools - Standing Water

AUBURN

Upper STONEVILLE Re

DAM No. 3-14-17-02

SKETCH #2



UPPER MONTGOMERY RESERVOIR

03-02

NEW ENGLAND POWER SERVICE COMPANY



441 STUART STREET, BOSTON 16, MASS.

September 13, 1955

Mr. L. O. Marden, County Engineer
County Court House
Worcester, Massachusetts

Dear Mr. Marden:

In accordance with your request during our meeting on September 9, 1955, I am sending you herewith a copy of my memorandum of November 30, 1954, to T. H. Butler of the Worcester County Electric Company, reporting on our studies regarding your proposed auxiliary spillway at the Upper Stoneville Reservoir Dam.

Yours very truly,

NEW ENGLAND POWER SERVICE COMPANY

E. P. Moseley
E. P. Moseley
Assistant Civil Engineer

UPPER STONEVILLE RESERVOIR

- COPY -
MEMORANDUM

TO T. H. Butler

FROM E. P. Moseley

SUBJECT _____

Worcester
COMPANY OR LOCATION

Boston
COMPANY OR LOCATION

November 30, 1954

FILE _____

We have made studies regarding an increase in the spillway capacity of the Upper Stoneville Reservoir about as proposed by County Engineer L. O. Marden, and enclose a plan showing a tentative scheme which we estimate would cost about \$2,000.00.

We have also made hydraulic studies of the past, present, and proposed spillway conditions, based on the discharges recorded at the U.S.G.S. gage on the Blackstone River at Worcester. This record covers the 31 year period from 1924 to 1954 including the major floods of record in 1936, the hurricane flood of 1938 and the 1954 flood due to hurricane "Edna".

Having no continuous record of pond elevations at Upper Stoneville we have assumed that the runoff per square mile of drainage area at that point would be 1.89 times as great as that at the U.S.G.S. gage, in accordance with a formula in general use in making comparisons of this sort based on the difference in drainage areas at the two points.

As a means of comparing the benefits to be expected from the proposed additional spillway capacity we have assumed:-

- A. That the spillway capacity of the structure previous to the lowering of the concrete crest and the provision of flashboards in 1951, existed during the entire 31 year period.
- B. That the capacity provided by the 1951 installation existed during the entire 31 year period.
- C. That the proposed capacity had been available during the entire 31 year period.

The following tables indicate the discharge capacities under conditions A, B and C in cubic feet per second (CFS) and cubic feet per second per square mile (CSM) for various pond elevations at Stoneville, the corresponding discharge (in CSM) at the U.S.G.S. gage, the number of times such discharges occurred during the 31 year period at the gage and the percentage of these discharges as compared with the 1936 maximum flood of record. In all cases it has been assumed the control pipe under the dam at the two gates at the spillway were wide open before water passed over the spillway. Any possible benefit from discharge over the low saddle in the needed area north of the dam has been ignored as being too uncertain to rely upon.

UPPER STONEVILLE RESERVOIR

A. Under this condition the concrete spillway crest was at elevation 0.0. There were no flashboards and the top of the embankment was at elevation 2.0.

UPPER STONEVILLE RESERVOIR

<u>Pond Elevation</u>	Stoneville Discharge		U.S.G.S. Gage Discharge	Number of Occurrences in 31 yr. Period	% of 1936
	CFS	CSM	CSM		
El. 0.0	90	36.4	19.3	7	24
El. 1.0 with 1 foot of freeboard	160	64.7	34.2	3	42
El. 2.0 with no freeboard	280	113.3	60.0	1	75

B. Under this condition the concrete spillway is at elevation -2.0, the tops of the 2'-0" flashboards are at elevation 0.0 and the top of the embankment is at elevation 2.5. The flashboards fail when the pond surface is about one foot over the boards or at elevation 1.0.

<u>Pond Elevation</u>	Stoneville Discharge		U.S.G.S. Gage Discharge	Number of Occurrences in 31 yr. Period	% of 1936
	CFS	CSM	CSM		
El. 0.0	90	36.4	19.3	7	24
El. 1.0 before board failure	160	64.7	34.2	3	42
El. 1.0 after board failure	340	137.5	72.8	1	90
El. 1.5 with 1 ft. freeboard	400	162.0	85.7	0	106
El. 2.5 with no freeboard	550	222.0	117.5	0	146

C. Conditions under this assumption are the same as in "B" except that 25 feet of additional spillway has been added dressed with two feet of flashboards which would fail with the pond level at elevation 1.5 or 1¹6" over the top of the boards.

<u>Pond Elevation</u>	Stoneville Discharge CFS CSM		U.S.G.S. Gage Discharge CSM	Number of Occurrences in 31 yr. Period	% of 1936
El. 0.0	90	36.4	19.3	7	24
El. 1.0 before present board failure,	250	101.0	53.5	1	67
El. 1.0 after present board failure,	425	172.0	91.1	0	113
El. 1.5 before pro- posed board failure	555	225.0	119.0	0	148
El. 1.5 after pro- posed board failure with 110" freeboard.	835	342.0	181.0	0	225
El. 2.5 with no freeboard.	1190	481.0	254.0	0	316

Assuming that one foot of freeboard is the least that could be considered safe, it is evident from the data above that the discharge capacity was increased from 64.7 CSM to 162.0 CSM by the improvements of 1951 or about 250% and that the present capacity would be increased from 162 CSM to 342 CSM or about 210% if the proposed increased capacity is provided.

It is also evident from table "B", that the present flashboards would probably have failed only three times during the 31 year period, and from table "C" that the present boards would have failed only once and the proposed additional boards not at all during that period.

Although the present installation appears entirely safe when only the maximum flood of record is considered, such small regions as this 2.47 square mile drainage area are often subjected to cloudbursts which result in very high runoff conditions. If such occurred the 342 CSM discharge capacity provided by the proposed 25 foot spillway extension would certainly make the structure safe except during very exceptional storms.

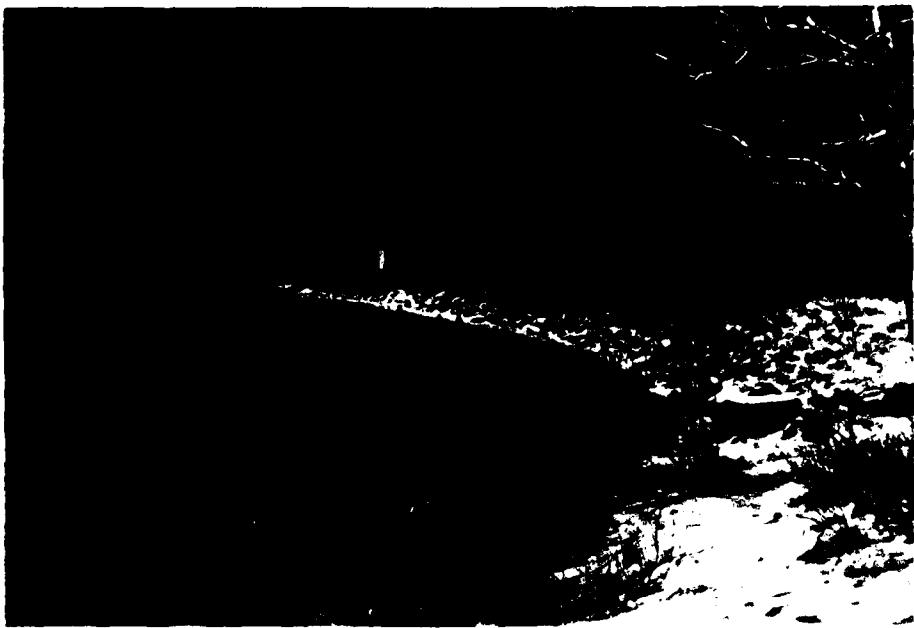
In view of the fact that Mr. Marden's proposals can be met at a reasonable cost, I would suggest another meeting with him at which our tentative plan could be discussed and at which we could make certain that the spillway capacity provided would meet his final requirements.

CC: T. J. Rouner
A. S. Walker
T. H. Butler

UPPER STONEVILLE RESERVOIR

APPENDIX C
PHOTOGRAPHS

UPPER STONEVILLE RESERVOIR DAM



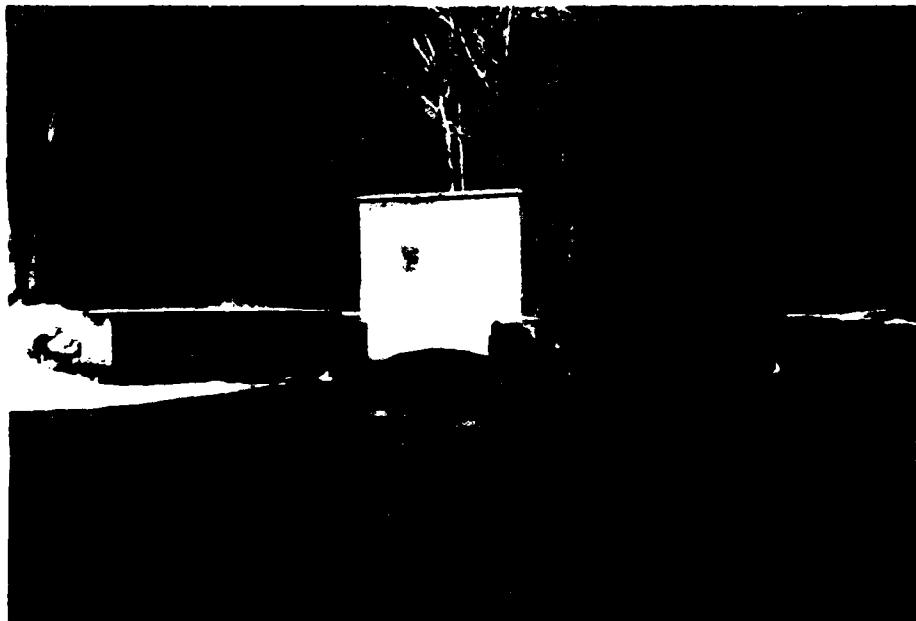
NO. 1 UPSTREAM VIEW OF DAM



NO. 2 DOWNSTREAM FACE OF DAM

UPPER STONEVILLE RESERVOIR DAM

C-1



NO. 3 UPSTREAM VIEW OF MAIN SPILLWAY



NO. 4 DOWNSTREAM VIEW OF MAIN SPILLWAY AND GATE HOUSE

WILLIAM PENN RIVER DAM



NO. 5 LOW AREAS ADJACENT TO MAIN SPILLWAY



NO. 6 OUTLET CONDUIT AT DOWNSTREAM WALL OF DAM

UPPER STONEVILLE RESERVOIR DAM



NO. 7 DOWNSTREAM VIEW OF AUXILIARY SPILLWAY WITH FLASHBOARDS



NO. 8 DISCHARGE CHANNEL BELOW AUXILIARY SPILLWAY

UPPER STONEVILLE RESERVOIR DAM

APPENDIX D

HYDROLOGIC AND HYDRAULIC
COMPUTATIONS

	<u>Page</u>
Figure D-1 Drainage Area - Upper Stoneville Reservoir Dam	D-1
Figure D-2 Watershed of Southworks Pond	D-2
Hydrologic and Hydraulic Computations	D-3

UPPER STONEVILLE RESERVOIR DAM

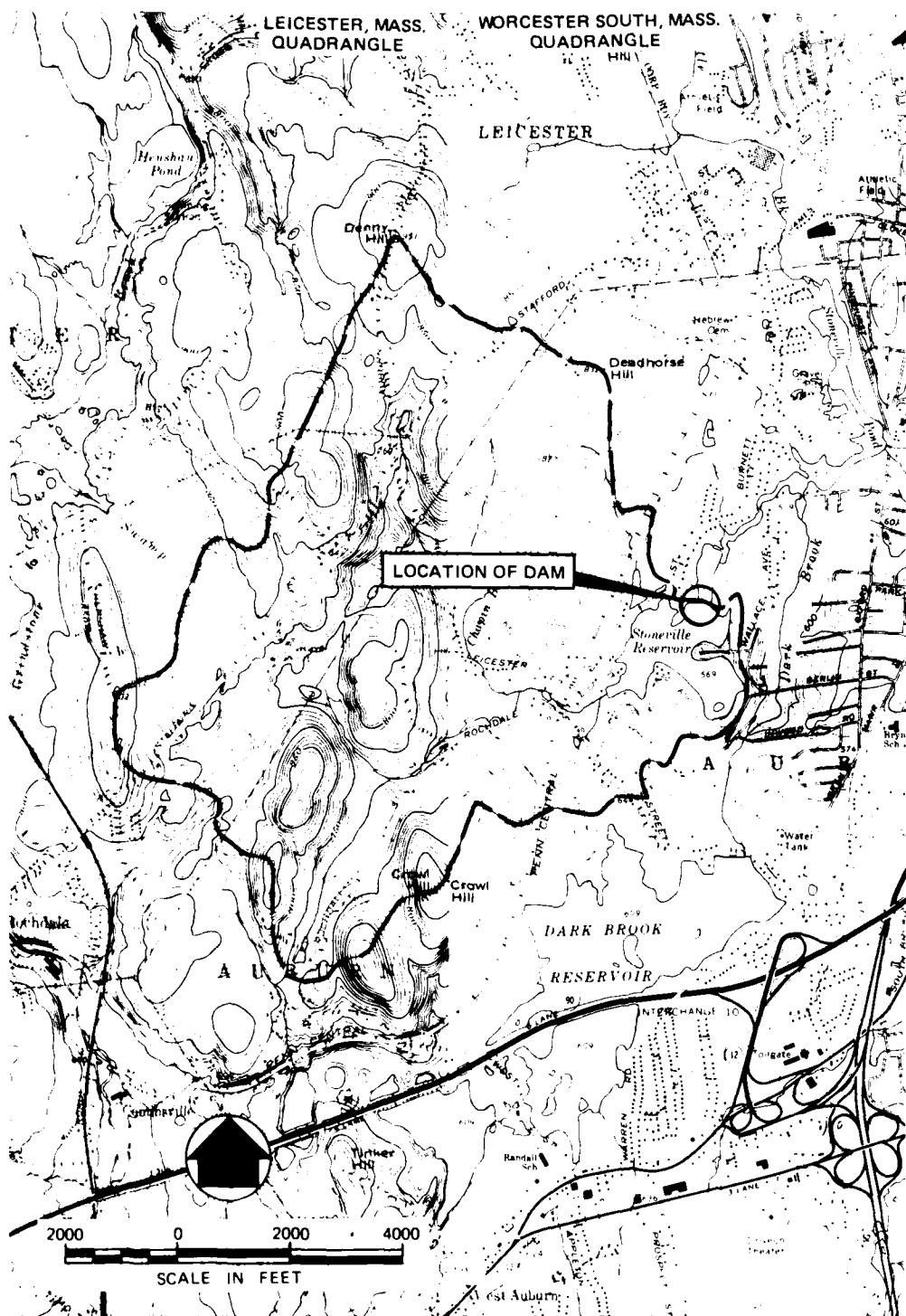
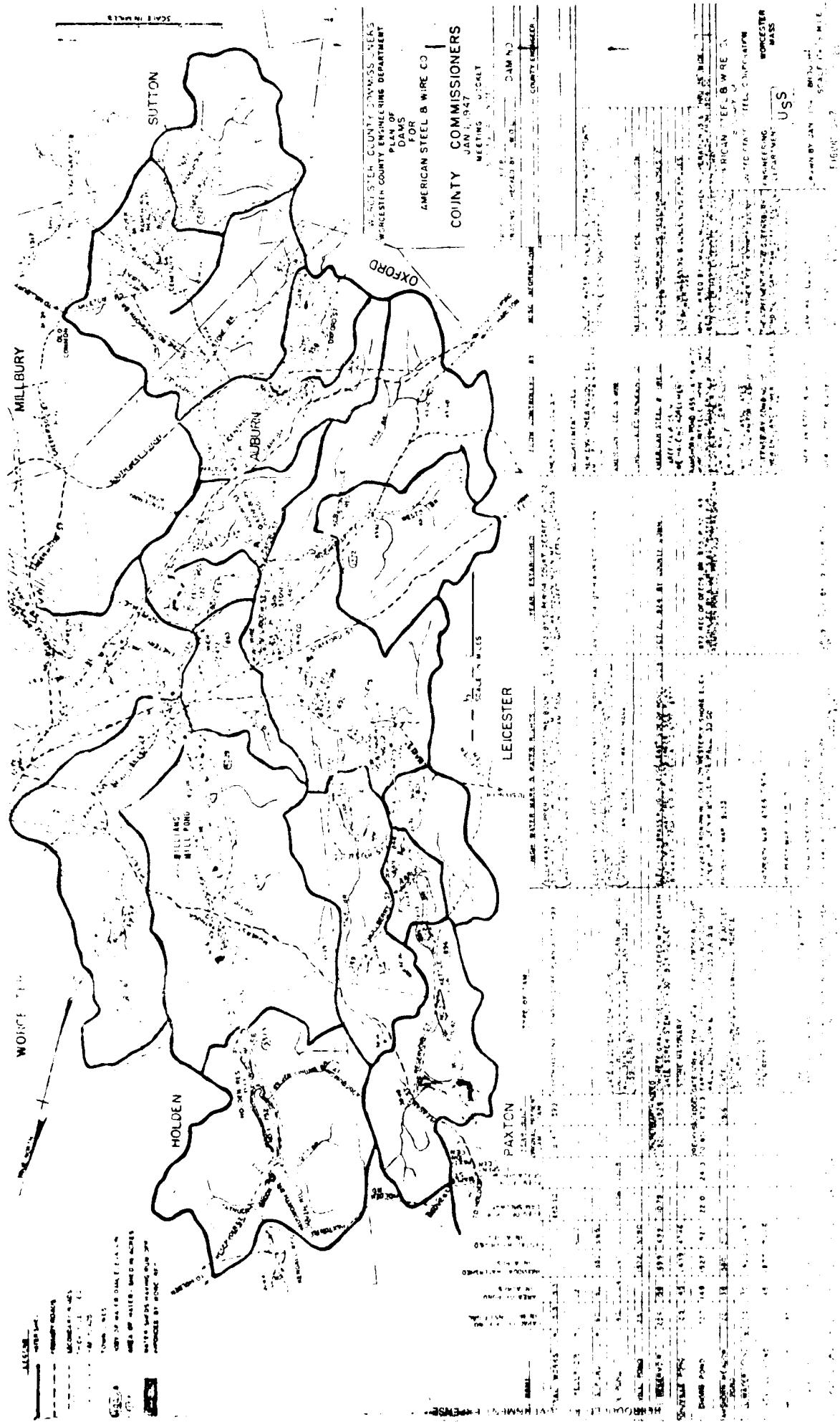


FIG. D-1 DRAINAGE AREA MAP – STONEVILLE RESERVOIR



Project Nat. Review of Non Fed. Dams Job No 6191 Page 1 of 5
 Subject Worcester County, Mass Commr. By LEB Date 12/8/78
 Detail Upper Stonyville Res. Ex. By RWR Date 12/20/78

I Test Flood, storage & Storage Functions

1- Total Drainage Area = 2.67 mi²

2- Pond(s) Area: 0.10 = 0.10 mi²

Swamp(s) Area: 0.01 + 0.03 + 0.03 + 0.05 + 0.05 = 0.17

Total Area Pond(s) & Swamp(s): 0.27 mi²

% Ponds & Swamps = $\frac{0.27}{2.67} = 10\%$

3- $\frac{951 - 569}{11,700} = 3.26\% \quad \} \text{Say Ave Slope} = 3\%$

4- Using C. of E. Curves for Peak Flow Rate & above guide values the Peak Flow Rate was estimated to be midway between Rolling & Flat & Coastal, and taken at 1550 c.f.s./mi²
 Size Class: Small ; Hazard Pot: High ; Spill. Des. Flood: 1/2 PMF to Full PMF
 Use: Test Flood = 1/2 PMF

5- Test Flood Inflow = $\frac{1}{2}(1550)2.67 = 2100 \text{ cfs.}$

6- Pond Storage

The pond area is 0.10 sq. mi. at elev. 569.

Based on a const. area D, storage increases at 64 ac. feet per foot of depth increase.

With the pond level at 574, 320 ac. feet of water is stored, above the spillway crest

7- Storage Functions are based on $D_{out} = Q_{in} \left[1 - \frac{S_{out}}{R} \right]$

S_{out} = Storage Vol. in Reservoir related to final D_{out}
 in terms of inches of rain over the drainage area.

$$S(\text{in inches}) = 12 D \left(\frac{0.10}{2.67} \right) = 0.45 D ; R = 3 \text{ hr rain = 0.3 in}$$

D = Storage Depth (above spillway) in feet

8- Storage Functions: (F_T) ; D = 0 @ Pond El. 569

$$F_T = 2100 - 221 \quad S = 2100 - 100 D$$

Project Nat. Review of NonFed. Dams Acct No 6191 Page 2 of 5
 Subject Worcester Mass. Area Comptd. By LEB Date 12/14/78
 Detail UPPER STONEVILLE RESERVOIR Ckd. By RW Date 12/20/78

(II) Discharge Ratings

A West Spillway

Crest Elev. 569.68, Length 25', Omit Side Contractions

Type Crest - Broad, Use $g = 3.1 H^{1.5}$ [Ref. H.T. Chow, Op. Chan Hyd. pp 360-362]

$$Q_w = 77.5 H^{1.5} \text{ (Assume Flashboards Out.)}$$

Pond El.	570	571	572	573	573.3	574	575
H_w	0.32	1.32	2.32	3.32	3.62	4.32	5.32
Q_w	14	120	270	470	530	700	950

B East Spillway

Crest Eleu 569.0, Length 15', Omit Side Contr.

Type Crest - Broad, Use $g = 3.1 H^{1.5}$ or $Q_E = 46.5 H^{1.5}$
 (Assume Flashboards Out.)

Pond El.	570	571	572	573	573.3	574	575
H_E	1	2	3	4	4.3	5	6
Q_E	46	130	240	370	410	520	680

C East Outlet Slurces

2 @ 2' wide x 2.5' high, Invert 567.89, Top 570.39
 Treat as orifice for Pond El. > 571 ; $Q_s = A (0.6) \sqrt{2gH_s} = 48 H_s^{1.5}$
 H_s meas. from pd. eleu to & openings @ eleu. 569.12

Pond El.	572	573	573.3	574	575	Lower Pd from 572 to 571
H_s	2.86	3.86	4.16	4.86	5.86	in $\frac{64(43800)}{90(3600)} = 9.7$ hours
Q_s	80	90	100	110	120	

D Central Low Level Outlet

15" ϕ , outlet invert eleu. 558.57, & outlet 559.2
 2 inlet losses, 2 outlet losses, friction $\approx 3.5 \sqrt{2g} = H_o$; $Q_o = 5.26 H_o^{1.5}$

Pond El.	569	570	571	573
H_o	9.8	10.8	11.8	13.8
Q_o	16	17	18	19

Project Nat. Review of Non Fed Dams Acct. No. 6191 Page 3 of 5
 Subject Worcester Mass. Area Comptd. By LEB Date 12/14/78
 Detail UPPER STONEVILLE RES Ckd. By RW Date 12/20/78

(II) Discharge Ratings (Cont.)

E - Crest Discharge

[Ref.: V.T. Chow, "Open Chan. Hyd.", pp 52-53]

$$\text{Use } q = 2.55 (H_c)^{1.5}$$

Crest Elev.: 105' @ 573.3, 450' @ 574.5;

$$Q_1 = 105(2.55) (PondEl. - 573.3)^{1.5} = 267.8 H_{c_1}^{1.5}$$

$$Q_2 = 450(2.55) (PondEl. - 574.5)^{1.5} = 1147.5 H_{c_2}^{1.5}$$

Pond El.	574	575	576
H_{c_1}	0.7	1.7	2.7
H_{c_2}	—	0.5	1.5
Q_1	160	590	1190
Q_2	—	410	2110
Q_c	160	1000	3300

F - Total Discharge (No Flashboards)

West Spillway + East Spillway + East Outlet + Crest

Pond El.	570	571	572	573	573.3	574	575
Q_w	14	120	270	470	530	700	950
Q_e	46	130	240	370	410	520	680
Q_s	(omit here)*	80	90	100	110	120	130
Q_c	—	—	—	—	—	160	1000
Q_{Tot}	60*	250*	590	930	1040	1490	2750

(III) Crest Flow

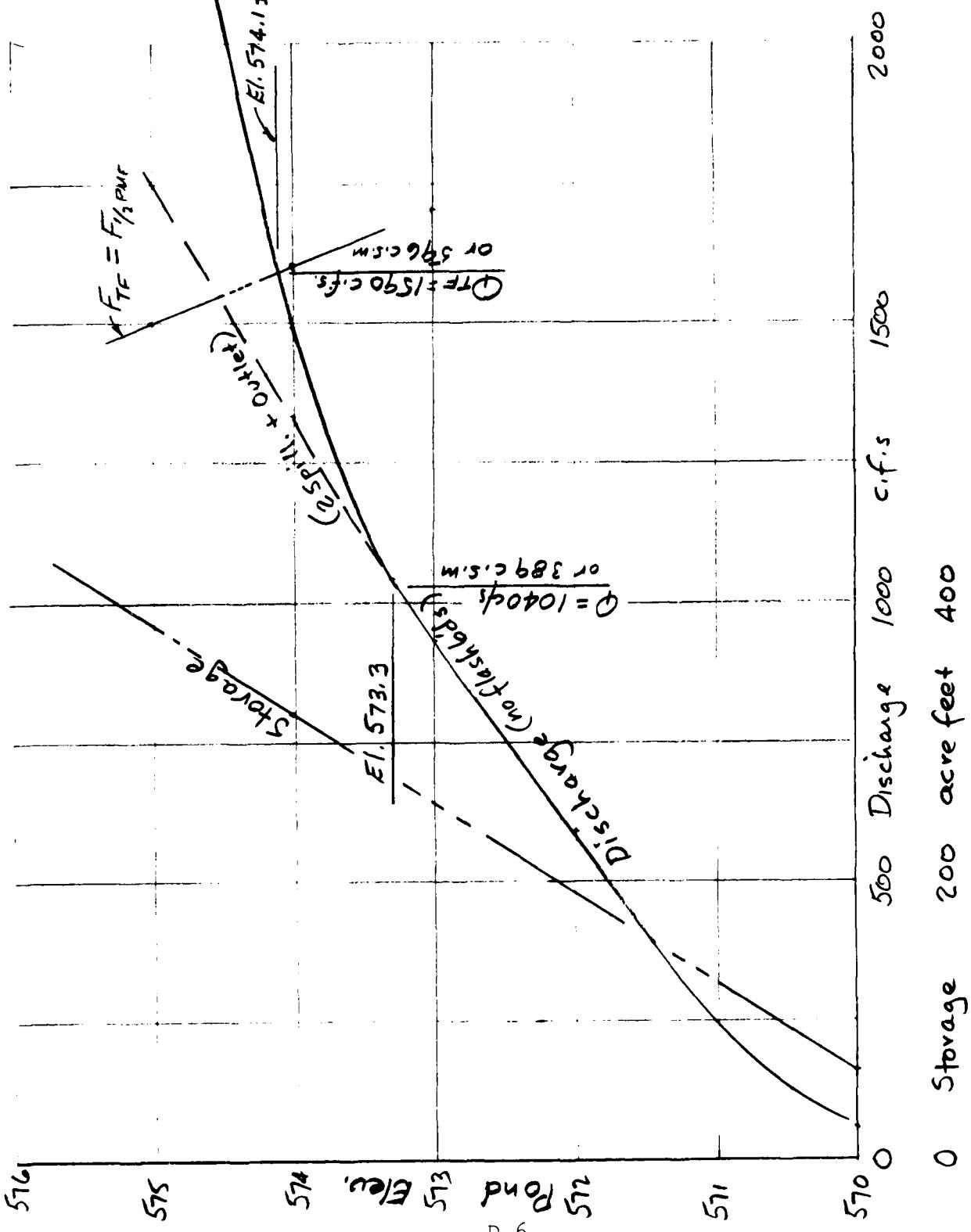
Test flood outflow w/ pond elev. 574.1, low pt crest @ elev. 573.3

$$\text{Unit crest disch.} = 2.55 (0.8)^{1.5} = 1.82 \text{ cfs/ft}$$

As critical flow: $y_c = 0.47'$, $V_c = 3.9 \text{ fps}$.

Project Nat. Review of NonFed. Dams Acct. No. 6191 Page 4 of 5
 Subject Worcester Mass. Area Comptd. By LEB Date 12/14/78
 Detail UPPER STONEVILLE RES Ck'd. By RW Date 12/20/78

IV Discharge, Storage & Storage Function vs Pond Elevation



Project Nat Review of NonFed Dams Acct. No. 6191 Page 5 of 5
 Subject Worcester Mass. Area Comptd By LEB Date 12/14/78
 Detail UPPER STONEVILLE RES. Ckd. By RWF Date 12/20/78

IV Failure of Dam

Peak Failure Flow:

Pond Elevation - 573.3 (lowest crest elev.)

Toe Elevation - 558.6

$$Y_0 = 14.7'$$

Dam Length Subject to Breaching = 200' (el. 566 ±)

$$W_0 = 40\% (200') = 80'$$

$$Q_{P_1} = 1.68 W_0 (Y_0)^{1.5} = 1.68 (80) (14.7)^{1.5} = \underline{7600 \text{ cfs}}$$

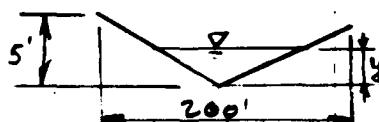
Storage Volume Released:

Storage Above Spillway (to elev. 573.3) = 275 ac.ft.

Storage Below Spillway = $\frac{1}{3} (10.4) 64 =$ 222 " "

$S = \text{Total Storage} =$ 497 " "

Channel Hydraulics:



$$n \approx 0.08, S = \frac{20}{550}, V = 3.55 R^{4/3}, R \approx \frac{1}{2} y, \therefore V = 2.24 y^{2/3}$$

$$A = \frac{1}{2} 40 y^2$$

Pond has 2 discharge channels. Failure is assumed to cause flow down only one - that from West spillway. At pond elev. 573.3 West spill discharge is 530 cfs, with channel depth $\approx 3.5'$. Total initial failure flow is 8130 cfs, with channel depth ≈ 9.5 ft.
 ∴ Failure wave is ± 6 ' high.

y	A	V	Q
5'	500	2.92	1462
10'	2000	4.64	9283
9'	1620	4.33	7009
9.5'	1805	4.48	8096
3'	100	2.08	374
4'	320	2.52	806

Time to Drain:

$$\frac{43560}{3600} \frac{(497)}{(\frac{1}{2})(7600)} = 1.6 \text{ Hours, or } 95 \text{ min.}$$

APPENDIX E
INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

UPPER STONEVILLE RESERVOIR DAM

INVENTORY OF DAMS IN THE UNITED STATES

NAME	STATE	COUNTY	CITY	STATE	COUNTY	CITY
ALBION	NEW YORK	ONEIDA	ALBION	NEW YORK	ONEIDA	ALBION
ALBION	NEW YORK	ONEIDA	ALBION	NEW YORK	ONEIDA	ALBION

NAME	STATE	COUNTY	CITY	STATE	COUNTY	CITY
ALBION	NEW YORK	ONEIDA	ALBION	NEW YORK	ONEIDA	ALBION
ALBION	NEW YORK	ONEIDA	ALBION	NEW YORK	ONEIDA	ALBION

NAME OF MUNICIPALITY	STONEVILLE, ALBION					
POPULAR NAME	ALBION					
RIVER OR STREAM	ALBION					
NEAREST TOWNSHIP	ALBION					
CITY-TOWN-VILLAGE	ALBION					
POPULATION	15500					
TYPE OF DAM	YEAR COMPLETED	PURPOSES	POWER CAPACITY	IMPROVING CAPACITIES	FEDERAL OWNED	SCS AVERAGE DATE
EARTH	1900	R	15	15	0	21 FEB 1979
REMARKS						
SPILLWAY	DISCHARGE CAPACITY	VOLUME OF WATER	POWER CAPACITY	REGULATORYGENCY	CONSTRUCTION	ENGINEERING BY
ALBION	10000	9000	5000	ALBION	ALBION	ALBION
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE	REINSPECTION	REINFORCEMENT	REMARKS
ALBION	1900	1900	1900	1900	1900	ALBION
INSPECTION BY	REINFORCEMENT	REINFORCEMENT	REINFORCEMENT	REINFORCEMENT	REINFORCEMENT	REMARKS
ALBION	1900	1900	1900	1900	1900	ALBION
REMARKS	ALBION					

END

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